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Plant communities of the upper Murrumbidgee catchment in New South Wales and the Australian Capital Territory

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Abstract: Native vegetation of the upper Murrumbidgee catchment in southeast NSW and the Australian Capital Territory (ACT) was classified into 75 plant communities across 18 NSW Vegetation Classes within nine Structural Formations. Plant communities were derived through numerical analysis of 4,106 field survey plots including 3,787 plots from 58 existing survey datasets and 319 new plots, which were sampled in under surveyed ecosystems. All plant communities are described at a level appropriate for discrimination of threatened ecological communities and distinct vegetation mapping units.

The classification describes plant communities in the context of the upper Murrumbidgee catchment and surrounding landscapes of similar ecological character. It incorporates and, in some instances, refines identification of plant communities described in previous classifications of alpine vegetation, forest ecosystems, woodlands and grasslands across the Australian Alps and South Eastern Highlands within the upper Murrumbidgee catchment. Altitude, precipitation, soil saturation, lithology, slope, aspect and landscape position were all important factors in guiding plant community associations.

Nine Threatened Ecological Communities under Commonwealth, NSW and ACT legislation occur in the upper Murrumbidgee catchment. This study has also identified five additional plant communities which are highly restricted in distribution and may require active management or protection to ensure their survival.

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Introduction

The classification of vegetation into distinct recurring species assemblages is an essential precursor to the mapping of vegetation distribution patterns. Together, vegetation classification and mapping are commonly used to inform biodiversity impact assessment and local and regional land use planning. Systematic vegetation classification and mapping also provide valuable information to identify

threats and risks to various components of biodiversity, and to prioritise specific ecological values for targeted protection.

Systematic vegetation classification based on numerical analysis of field survey data is widely used in Australia and other parts of the world where sufficient field data are available. Numerical analysis of field 'relevé' data has been progressively developed in Europe through the European Vegetation Survey project (e.g. see Bruelheide & Chytrý 2000; Tichý 2002; Schaminée *et al.* 2007; De Cáceres *et*

al. 2009). In the development of the United States National Vegetation Classification System, Grossman *et al.* (1998) noted that vegetation classification ideally should be based on the analysis of high quality field data spanning the full geographic and environmental range of related vegetation, and the subsequent US National Vegetation Classification Standard Version 2.0 (FGDC 2008) proposed that natural vegetation types be derived from analysis of field plot data, with these data providing the fundamental information for the numerical description of types.

Within NSW, many natural resource management decisions are made by Catchment Management Authorities (CMAs) based on information and assessment at the scale of broad catchments. Within the Murrumbidgee CMA area and the ACT, the upper Murrumbidgee River catchment contains a diverse range of landscapes and vegetation types which are subject to ongoing land-use pressures including clearing of native vegetation for farming and urban development, urban expansion and ongoing pastoral management. The upper Murrumbidgee catchment has a relatively high density of existing vegetation survey plot data collected by previous vegetation studies, ranging from specific conservation reserve surveys to a large regional inventory of forest ecosystems on public lands, but to date it has not had a systematic classification of all plant communities across all Structural Formations across all tenures.

This study aimed to classify and describe the native plant communities of the upper Murrumbidgee catchment at a consistent classification scale or level of detail, based on numerical analysis of the best available set of full-floristic field survey plot data. Plant communities were delineated and described at an ‘association’ level compatible with adjacent regional vegetation classifications and with NSW Scientific Committee determinations, and a level that could be recognised in the field by people with botanical training. The study will contribute to the NSW Vegetation Classification and Assessment project (Benson 2006) and the State-wide Vegetation Information System Classification Database (OEH unpublished a).

Study Area

The study area (referred to here as the ‘upper Murrumbidgee catchment’), an area of 1.741 million ha, within the Murrumbidgee catchment in NSW and the Australian Capital Territory (ACT) (Figure 1). The upper Murrumbidgee catchment is characterised by two distinctive bioregions (or IBRAs): the Australian Alps and the South Eastern Highlands (Thackway & Cresswell 1995, IBRA version 6.1). Approximately 86% of the upper Murrumbidgee catchment falls within the South Eastern Highlands bioregion, with the Australian Alps bioregion comprising the remaining 14%. Most bioregions contain multiple subregions, based on finer differences in biophysical attributes such as vegetation,

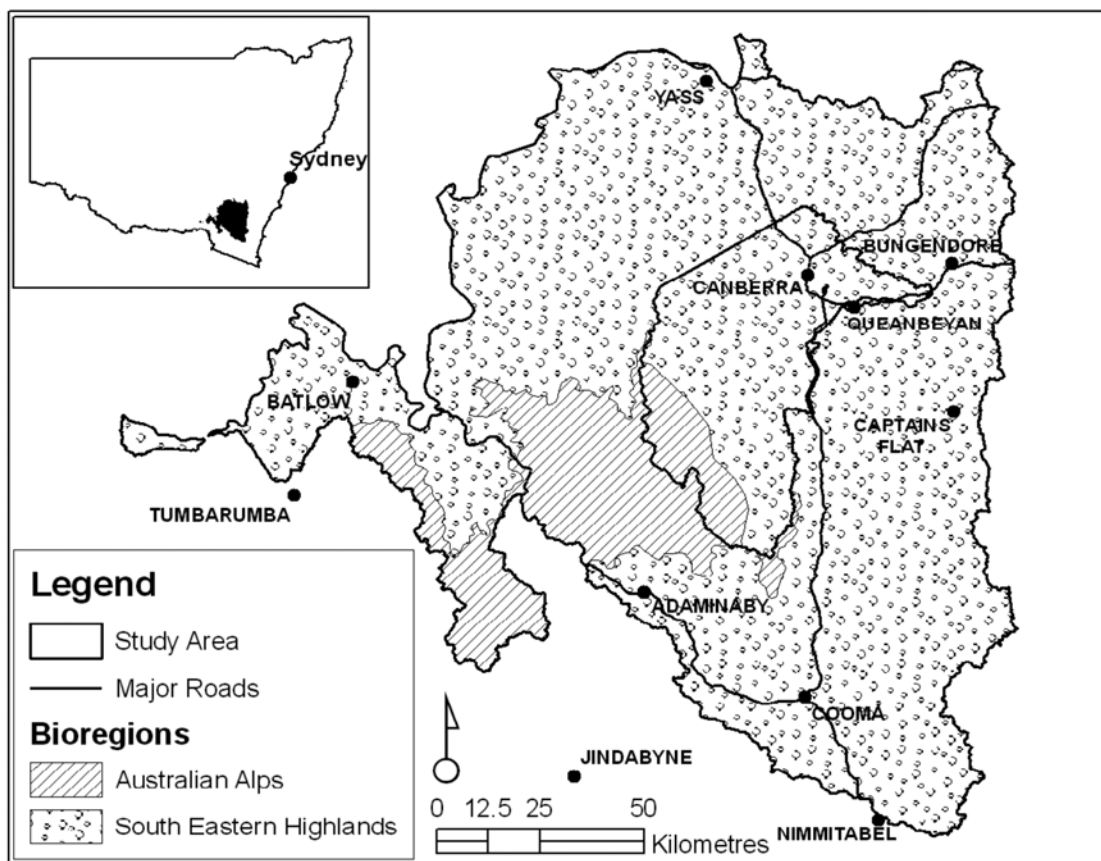


Fig. 1. The upper Murrumbidgee catchment study area including major population centres, roads and bioregions.

geology and soil type (NPWS 2003a). The Australian Alps bioregion contains only one subregion (Australian Alps), which occurs across the Alps in NSW, Victoria and the ACT. The South Eastern Highlands bioregion contains ten subregions, five of which (Bondo, Crookwell, Kybean – Gourock, Monaro and Murrumbateman) occur within the upper Murrumbidgee catchment (Figure 2). The biophysical characters of these subregions are outlined in Table 2.

The upper Murrumbidgee catchment encompasses parts of 11 local government areas: Cooma-Monaro, Goulburn-Mulwaree, Greater Hume, Gundagai, Palerang, Queanbeyan City, Snowy River, Tumbarumba, Tumut, Upper Lachlan

and Yass Valley, as well as the entire jurisdiction of the ACT. Cities within the study area include Canberra and Queanbeyan, with regional centres including Adaminaby, Batlow, Bungendore, Captains Flat, Cooma and Yass. The upper Murrumbidgee catchment is primarily within the Southern Tablelands botanical subdivision, with parts of the north-west within the South Western Slopes botanical subdivision (Anderson 1961).

In developing a plant community classification for the upper Murrumbidgee catchment it was recognised that many plant communities would be distributed beyond the edges of the catchment, particularly in similar tableland environments to

Table 1: Climate data for the study area.

Location	Altitude (m)	Highest mean max. mean daily temp (°C)	Lowest mean max. mean daily temp (°C)	Frost days (ave. no. days/year of daily min. ≤ 0°C)	Ave. annual precipitation (mm)	Lowest mean monthly rainfall (mm)	Highest mean monthly rainfall (mm)
Cabramurra	1482	21.4 (Jan)	- 0.9 (Jul)	81	1155	43 (Jan)	135 (Aug)
Canberra Airport	578	28.0 (Jan)	- 0.1 (Jul)	60	616	40 (Jun)	64 (Nov)
Cooma (Visitors centre)	778	27.2 (Jan)	- 2.8 (Jul)	104	533	27 (Aug)	66 (Nov)
Thredbo AWS *	1957	16.3 (Feb)	- 5.3 (Jul)	167	1355	85 (June)	151 (Sep)
Tumbarumba PO	655	28.7 (Jan)	- 0.2 (Jul)	60	976.4	54 (Feb)	107 (Aug)
Yass	520	29.5 (Jan)	1.1 (Jul)	46	651	46 (Feb)	65 (Oct)

Source: BoM (2011)

* Thredbo is located outside the upper Murrumbidgee catchment, but is included as an indication of the climate of alpine areas within the study area.

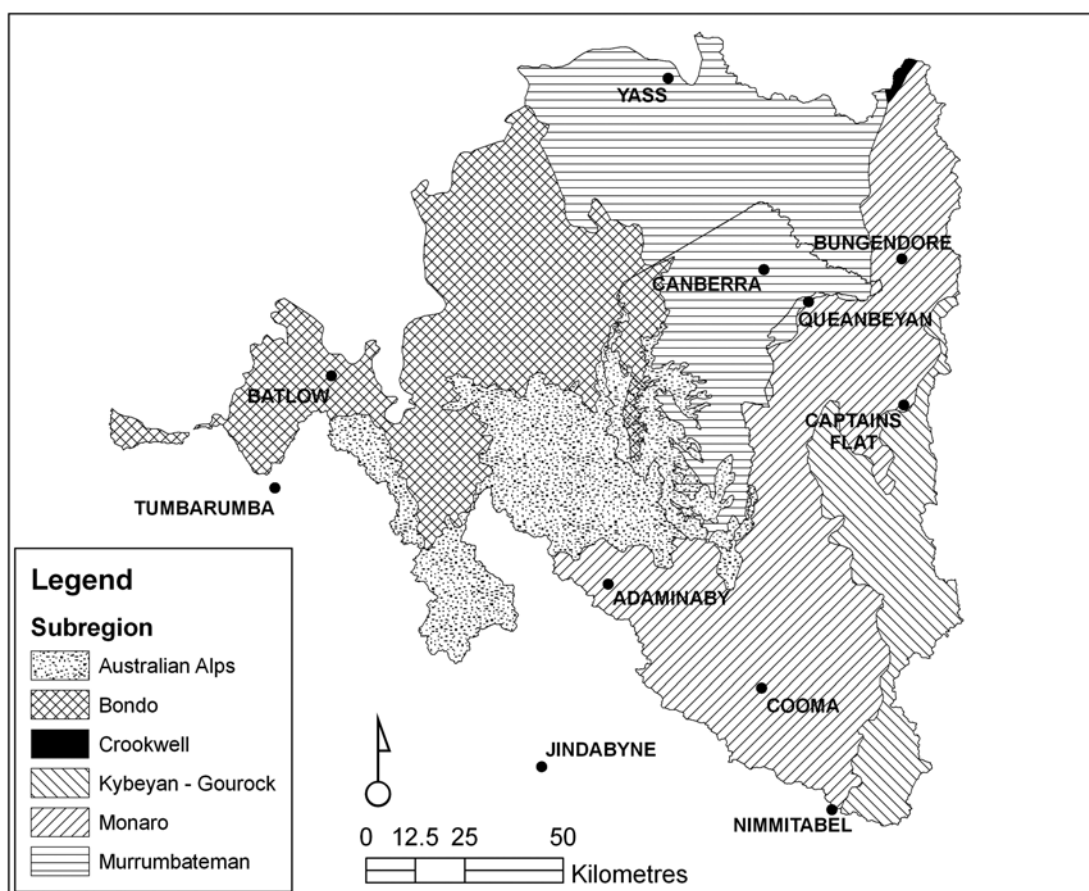


Fig. 2. IBRA subregions of the upper Murrumbidgee catchment study area.

the north and south. In order to address this issue, floristic plot data from a broader area (referred to as the ‘broader analysis area’) were included. This encompassed the Australian Alps and South Eastern Highlands bioregions from the Victorian border north to Oberon Shire. The broader analysis area included a 10 km buffer on the western edge of the study area, and all of Boorowa Shire.

Climate

Climate varies greatly across the upper Murrumbidgee catchment, in response to topographic variation and its effect on atmospheric pressure, wind, precipitation, light and cloud cover. The Australian Alps bioregion contains areas of alpine, sub-alpine and montane landforms, with the South East Highlands being primarily tablelands with occasional montane features (Costin 1954).

Mean annual precipitation from weather station records ranges from 533 mm at Cooma within the Monaro rain shadow to 1,115 mm at Cabramurra on the main Kosciuszko range (Table 1; BoM 2011). Annual precipitation is highest in the southwest, where alpine peaks are modelled as receiving up to 2,150 mm, much of this as snow in cooler months. Within the Monaro rain shadow, annual precipitation is modelled to be as low as 450 mm southwest of Cooma, where a lack of rainfall combined with severe winter frosts restricts tree growth (Figure 3) (Anon 2009). Cooma has the

highest recorded temperature variation, with a highest mean daily temperature of 27.2°C in January and a minimum mean daily temperature of - 2.8°C in July (BoM 2011).

Settlement and landuse

The upper Murrumbidgee catchment was occupied by Aboriginal people for at least 21,000 years before European settlement (Lennon 2003, Hancock 1972). The Walgulu and Djilamatang people generally utilised the alpine areas, with Ngunnawal and Ngarigo people on the slopes and tablelands. At times, Wiradjuri people may have extended eastward into western sections of the study area (Tindale 1974). European settlers started arriving in the mid-1820s, with squatters establishing pastoral camps over much of the Monaro by the 1830s (Hancock 1972). Pastoralism commenced in the Australian Alps in the 1820s (HO & DUAP 1996) and by the 1850s most of the Alps were used for stock grazing during the warmer months (Lennon 1999).

Climate, remoteness and the rugged terrain influenced both Aboriginal and European settlement and land use patterns (Lennon 2003). Easily accessible parts of the upper Murrumbidgee catchment have been developed primarily for wool and beef production; other land uses include urban development, forestry, cereal cropping (Hancock 1972), and conservation in national parks such as Kosciuszko NP. Other land uses include gold mining, the Snowy Mountains Hydro-

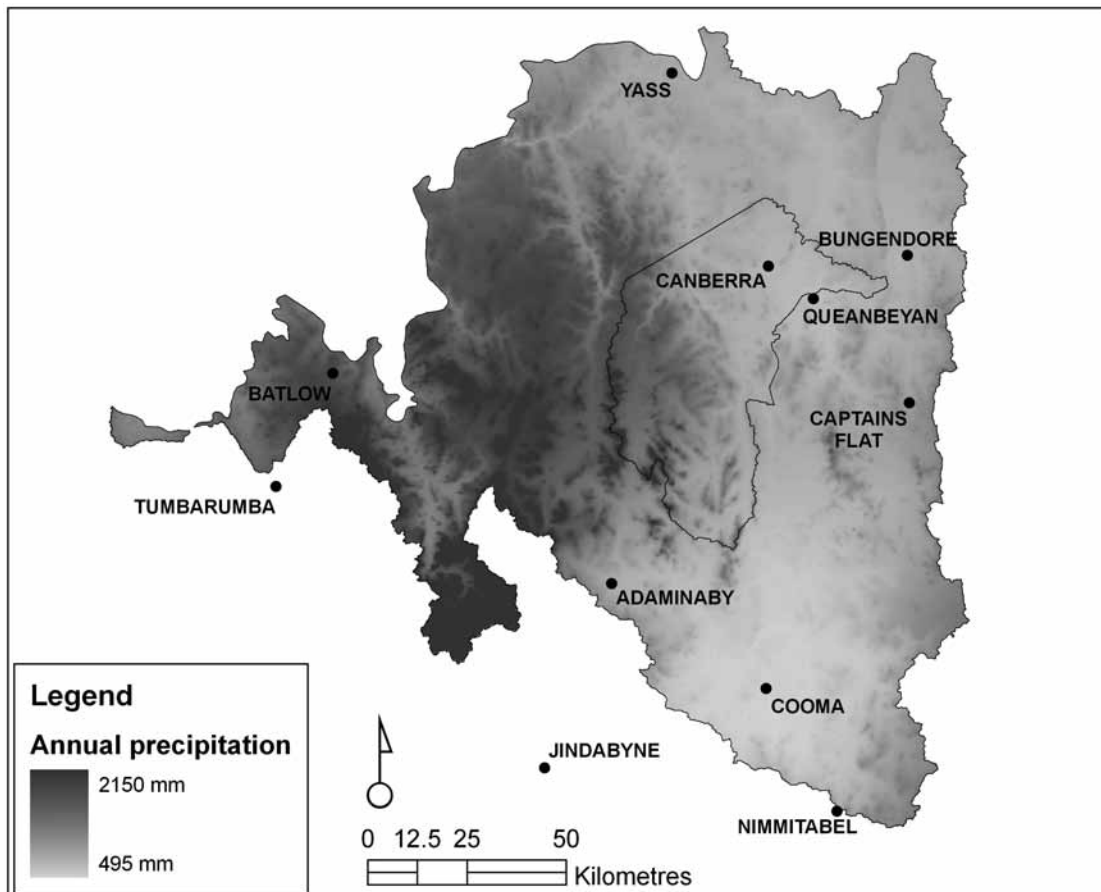


Fig. 3. Annual precipitation of the study area, showing higher rainfall in alpine and montane areas, and the dry Monaro rainshadow around Cooma.

Table 2: Characteristics of IBRA subregions of the study area.

Subregion	Area (ha)	Geology	Characteristic Landforms	Typical Soils	Vegetation
Australian Alps	200,947 (NSW) 40,378 (ACT)	Block faulted granites and Palaeozoic metamorphic rocks. Small areas of Tertiary basalt with buried river gravels and lake sediments. Quaternary glacial landforms and sediments above 1,800 m, more extensive periglacial features above 2,100 m.	Low-relief high plains with steep margins and slopes and fault aligned river valleys with deep gorges and waterfalls. Relic cirque glaciers, blockstreams and periglacial solifluction lobes in highest regions.	Soils change with altitude. At lower levels in forests texture contrast soils are the norm. In the sub-alpine forests areas deep gradational soils with moderate amounts of organic matter are common. Above the reeline, wet alpine humus soils with abundant organic matter are widespread. Steep slopes have stonier, shallow profiles.	Vegetation changes with altitude, aspect, cold air drainage and soil saturation. Low elevations with dry aspects carry <i>Eucalyptus macrorhyncha</i> , <i>E. rossii</i> , <i>E. dives</i> , <i>E. rubida</i> and <i>E. mannifera</i> . Moist sites have <i>E. delegatensis</i> , <i>E. dalyrpleana</i> , <i>E. viminalis</i> , <i>E. radiata</i> subsp. <i>radiata</i> , and <i>E. fastigata</i> . Between 1,000 and 1,500 m <i>E. delegatensis</i> and <i>E. dalyrpleana</i> dominate and abruptly change to subalpine <i>E. pauciflora</i> subsp. <i>pauciflora</i> and <i>E. pauciflora</i> subsp. <i>niphophila</i> woodlands, heaths, grasslands and bogs between 1,500 and 1,800 m. Alpine herbfields and rare fieldmark communities are found above the treeline.
Bondo	363,210 (NSW) 20,224 (ACT)	Silurian and Devonian acid intrusive, fine grained Palaeozoic sedimentary and metasedimentary rocks and areas of granite.	Rugged hills, with small plateau areas. Steep stony slopes and string structural control on ridge lines.	Red earths and red texture contrast soils. Typically thin and stony on slopes, thickening on footslopes, and becoming yellow and harsh on valley floors.	<i>E. radiata</i> subsp. <i>robertsonii</i> , <i>E. macrorhyncha</i> , <i>E. viminalis</i> and <i>E. dalyrpleana</i> open forests.
Crookwell	2,488 (NSW)	Fine grained Ordovician and Silurian sedimentary rocks, with some granites. Tertiary basalts with buried river gravels along ridges well above present streams.	Hilly, with some rugged areas and steep valleys. Hill tops may be small plateaus or capped by basalt and showing inverted relief.	Red and yellow texture contrast soils, thin and stony on steep slopes. Stony brown structured loams on basalts.	<i>E. bridgesiana</i> , <i>E. dalyrpleana</i> with <i>E. blakelyi</i> and <i>E. melliodora</i> . <i>E. macrorhyncha</i> , <i>E. albens</i> , <i>E. dives</i> and <i>E. mannifera</i> on stony ridges in the north. Small patches of <i>E. cinerea</i> .
Kybeyan – Gourrock	155,107 (NSW)	Devonian quartz-rich sedimentary rocks with minor areas of limestone, and areas of Silurian-Devonian granitoids at higher elevations in the south. Ordovician quartz-rich sedimentary and metamorphic rocks in the west.	Rocky ranges, moderate to steep lower to mid slopes. Stony outcrops along ridgelines.	Red and yellow texture contrast soils, becoming deeper and more poorly drained down slope. Thin brown stony loams and transitional alpine humus derived from granitoids at higher elevations in the south.	<i>E. fastigata</i> , <i>E. viminalis</i> , and <i>E. radiata</i> subsp. <i>radiata</i> on hillslopes, with <i>E. melliodora</i> , <i>E. blakelyi</i> and <i>E. mannifera</i> at lower elevations. Some west facing patches of <i>Allocasuarina nana</i> heathland. Strong aspect influences on plant associations.
Monaro	530,798 (NSW) 882 (ACT)	Block faulted ranges and closed lake basins in Silurian and Devonian acid fine grained sedimentary and metamorphic rocks with some granites. Extensive areas of thin Tertiary basalt flows over lake and river sediments.	Sloping plateau rising from 600 to 1,300 m north to south. Structural ridges of more resistant rock. Stepped plains on basalt with intervening low areas of granite or sedimentary rocks. Numerous shallow lakes and swamps, a few permanent. Many and closed basins and periodically dry. Area is in rainshadow with rainfall 450 – 750 mm.	Harsh yellow texture contrast soils in general. Shallow red brown to black stony loams on basalt.	<i>E. pauciflora</i> subsp. <i>pauciflora</i> , <i>E. viminalis</i> , <i>E. rubida</i> , <i>E. dives</i> and <i>E. dalyrpleana</i> woodlands with <i>Themeda australis</i> understorey. <i>E. rossii</i> and <i>E. mannifera</i> on hills. Extensive grasslands of <i>Poa</i> spp., <i>Austrorostipa</i> spp. and <i>Rytidosperma</i> spp. on the driest plains with clumps of <i>Poa</i> spp. amongst rocky outcrops.
Murrumbidgee ateman	280,798 (NSW) 174,316 (ACT)	Fine-grained Palaeozoic sedimentary and metasedimentary rocks, with minor areas of course acid volcanics. Tertiary alluvial terraces along main streams.	Undulating plateau with rounded hills and peaks, entrenched meandering streams with chain of pond tributaries.	Mottled yellow and brown texture contrast soils with strongly bleached topsoils. Dark organic loams and clay loams on valley floors. Saline patches present.	<i>E. blakelyi</i> and <i>E. melliodora</i> on lower slopes. <i>E. macrorhyncha</i> , <i>E. rossii</i> and <i>E. norronii</i> on ridges. Areas of <i>E. bridgesiana</i> and <i>E. mannifera</i> . Limited swampy flats and valley floor grasslands.

Electric scheme and recreational ski-field development in the Alps, and orcharding in the central and western parts of the South Eastern Highlands.

Natural vegetation in the upper Murrumbidgee catchment has been affected by domestic grazing, tree clearing (including ringbarking and logging), cultivation, altered hydrology and altered fire regimes. Introduced herbivores and omnivores, including rabbit (*Oryctolagus cuniculus*), hare (*Lepus* spp.), horse (*Equus caballus*), deer (numerous genera of the *Cervidae* family), pig (*Sus scrofa*) and goat (*Capra hircus*) continue to have negative impacts on the structure and floristic composition of native plant communities. The severity of impacts varies depending on ecosystem resilience and the timing and intensity of the threats (Costin 1954).

Previous botanical studies

Past qualitative and quantitative botanical studies in the upper Murrumbidgee catchment include:

- A study of the vegetation and soils of the Monaro region and much of the Australian Alps bioregion (Costin 1954).
- Classifications of wetlands and grasslands of the Monaro (Benson & Jacobs 1994, Benson 1994).
- The Southern CRA Forest Ecosystem classification and mapping project, focussing on forest ecosystems on public lands (Thomas *et al.* 2000).
- Refinement of Thomas *et al.* (2000) undertaken by Gellie (2005).
- A classification of vegetation of the treeless alps in NSW and Victoria (McDougall & Walsh 2007).
- A classification of native vegetation of southeast NSW (Tozer *et al.* 2010), which refined and integrated previous work by Tindall *et al.* (2004), Keith & Bedward (1999) and others.
- A number of regional vegetation studies in the ACT (e.g. Ingwersen *et al.* 1974, Ingwersen 2001, Johnston *et al.* 2008, Sharp *et al.* 2007).

For a list of botanical survey data used as part of this study refer to Table 3.

Methods

Existing floristic survey data

Existing floristic survey data from the broader analysis area were compiled from datasets held by the NSW Office of Environment and Heritage in the 'YETI' database (Bedward *et al.* 2011). Datasets were assessed for inclusion in the analysis based on the following criteria (adapted from Keith & Bedward 1999):

- i complete list of vascular plant species within each survey plot (i.e. full-floristic plot survey), as well as the moss *Sphagnum* spp., which was important for alpine classification;

- ii plot location recorded with a precision of 100 m or better;
- iii species importance values recorded on a scale that could be transformed to a common cover-abundance scale;
- iv area of each plot within the range 0.04 to 0.1 ha.

Exceptions made to criterion (iv) were the dataset of McDougall & Walsh (2007), which included samples of between 0.002 and 0.05 ha, and the data of Benson & Jacobs (1994), which involved whole-lake samples of up to 215 ha in area. These datasets represented the only survey data available for these habitats within the area. The smaller area plots collected by McDougall & Walsh (2007) were considered to capture floristic variation for alpine plant communities.

The data compilation process included correction or masking of obvious taxonomic data entry errors, exclusion of plots that were clearly not full-floristic (e.g. canopy only or API-checking plots) and correction of obvious plot location errors (where georeference data did not match text location description).

A total of 3,787 survey plots from 58 survey datasets (Table 3) across the broader analysis area were accepted for inclusion in the analysis, including data from 193 plots in three surveys which were located and entered into the YETI database as part of this study. Spatial and floristic variation within these datasets formed the basis for planning additional survey using stratified and preferential sampling techniques (Bell 2013).

All plots stored in the YETI database are identified by unique alpha-numeric labels and many of the plots extracted from the current broader analysis area had been classified during one or more previous studies. The group definitions (or plot memberships of groups) of previous studies by Benson & Jacobs (1994), Gellie (2005), McDougall & Walsh (2007) and Tozer *et al.* (2010) were obtained to allow exploration of relationships between groups defined by these previous classifications and the current study.

Additional survey

Using a Geographic Information System (GIS), the distribution of existing survey plots was stratified by the NSW Landscapes ("meso-scale ecosystems") as delineated by Mitchell (2003), and revised by EcoLogical (2008). These Landscapes represent areas of similar geology, topography and climate. Based on existing survey plot data, under-sampled Landscapes were identified for further sampling. Calculations included a 10 km buffer beyond the upper Murrumbidgee catchment boundary, as existing survey plots outside this area, but within areas of similar biogeographic character would be included in the classification across the broader analysis area.

A total of 270 new field survey plots were proposed for sampling in remnant vegetation within 29 NSW Landscapes. Targeted plot locations were allocated across under-sampled Landscapes in the upper Murrumbidgee catchment using

Table 3: Datasets used as part of the floristic analysis.

YETI Survey identifier	No. of plots used	Reference	YETI Survey identifier	No. of plots used	Reference
ACT_GUD	188	Ingwersen (2001)	UMC1	40	this study
ACT_MT.WD	106	Gilmour <i>et al.</i> (1987)	UMC2	26	this study
ACT_UC	107	Helman <i>et al.</i> (1988)	UMC3	46	this study
ALP_ASH	61	DECCW (2010a)	UMC4	29	this study
AUSALPS	359	McDougall & Walsh (2007)	UMC5	25	this study
BALLNDCARE	29	Crawford (1999)	UMC6	32	this study
CS_CLYDE	22	Helman (1983)	UMC7	36	this study
EA_TSR	83	Hibberd & Taws (1993)	V_BOMBFB4	19	Miles (2005b)
EDENVI	9	Keith & Bedward (1999)	V_BONDIFB4	10	Crawford (2002b)
FLOYDRF	3	Floyd (1990)	V_COOLAFB4	9	Miles (2002)
kosc_extra	19	Miles & Robertson (2008)	V_COOLUFB4	9	Crawford (2002c)
KOWMUNG	110	Steenbeeke (1990)	V_COOMAFB4	27	Miles & McPherson (2004)
KOWMUNGHAK	5	Steenbeeke (1996)	V_MONGAFB4	6	Gellie (2002)
KTWETQUD	4	Turner (2007)	V_TANTYFB3	13	Miles (2001)
MER_SR	6	DECCW (2010b)	V_TBLD_FB4	5	Miles (2004)
MILES_06	16	Miles (2006)	WARRAGAMBA	70	NPWS (2003b)
MONWET	65	Benson & Jacobs (1994)	TOTAL:	4106	
NADGIG_NR	12	Miles (2010a)			
NALBAUGH	62	Binns & Kavanagh (1990)			
NP_BONDI	24	Fanning & Rice (1989)			
NP_BRIN	130	Doherty (1997a)			
NP_BUR	33	Doherty (1998; 2004)			
NP_DEUA	20	Gilmour (1985)			
NP_ECRA	66	Keith & Bedward (1999)			
NP_GOULB	36	Miles (2010b)			
NP_KOSI	39	AALC (no date)			
NP_MONGA	11	Miles (2007)			
NP_MUND	17	Doherty (1996)			
NP_SCQBYN	10	NPWS (undated a)			
NP_SCRA	788	Thomas <i>et al.</i> (2000)			
NP_TIND	1*	Doherty (1997b)			
NP_WADAN	5	Mackenzie <i>et al.</i> (1998)			
NP_WOGWO	12	Fanning & Fatchen (1990)			
NPA_ABER	32	Togher (1996)			
P_MONARFB4	33	Crawford (2002a)			
P5MA	506	Tindall <i>et al.</i> (2004)			
P5MA_XTRAS	2	Tindall <i>et al.</i> (2004)			
RH	43	NPWS (undated b)			
SCRA_NTH	39	Thomas <i>et al.</i> (2000)			
SEFCOMB	100	Keith & Bedward (1999)			
SF_BAGO	26	Binns (1997)			
SF_BM	4	Binns (1997)			
SF_BMFLS	64	Binns (1997)			
SF_MAR	5	Binns (1997)			
SF_QFS	100	Jurskis <i>et al.</i> (1995)			
SFTUMB04	24	Binns (2004)			
SWS_Gellie	133	EcoGIS (2004)			
TARAL	15	Fisher & Ryan (1994a)			
TOL_BUN_BN	35	Miles (2005a)			
UMC_ACT	31	ACT CP&R (2010)			
UMC_GA	54	this study			

* Note: 49 of the 50 survey plots collected by Doherty (1997b) were stored within the NP_SCRA survey.

a random point generator in the GIS, constrained to areas of public tenure [including national parks, State forests, travelling stock reserves (TSRs) and Crown reserves] and 22 private properties whose owners had granted access for surveys. A small number of random target locations were modified by moving to areas of greater accessibility, such as to within a few hundred metres of an access track. All moved target plots remained within the same Landscape and in a similar landscape position to that of the original randomly selected location (e.g. drainage line, mid-slope or hill top). A further 49 new field survey plots were sampled in vegetation or habitat types believed to be under-sampled based on consultation with local botanists and review of previous descriptions of plant communities across the study area.

Data collected for this study largely conform with the NSW Native Vegetation Type Standard (Sivertsen 2009), including recording of precise plot location, basic floristic structure, condition, tree health, physiography, land use, disturbance and full-floristic plot data with percent foliage cover. All surveyors estimated percent foliage cover for all taxa in each full-floristic quadrat; one team also recorded separate abundance scores. These new plots brought the total number of field survey plots available for analysis to 4,106. Table 3 summarises the sources of the plot data.

Data analysis

Floristic data from 4,106 field survey plots were collated in a relational database (Bedward *et al.* 2011) and exported in a format suitable for analysis. Through the export process all exotic taxa were excluded, a standardisation of taxonomic names was applied, and species-importance scoring systems were transformed to their closest equivalent on a cover-abundance scale of 1 to 6 (1: uncommon and less than 5% cover; 2: common and up to 5% cover; 3: up to 20% cover; 4: up to 50% cover; 5: up to 75% cover; and 6: over 75% cover) modified from Braun-Blanquet (1932). Exported data consisted of transformed cover-abundance values in a matrix of 4,106 plots (objects) by 2,067 taxa (attributes).

Exported data were examined using the homogeneity analysis algorithm developed by Bedward *et al.* (1992), to assess the number of floristic groups (i.e. the classification level) likely to be most efficient at describing the floristic diversity of the broader analysis area. This assessment, combined with review of previous plant community classifications covering parts of the study area, suggested an initial classification level of 200 groups.

Survey plot data were then analysed to search for groups of consistently co-occurring plant taxa at the chosen classification level, using the PATN software developed by Belbin (1995a, 1995b). Cluster analysis began with the PATN non-hierarchical clustering strategy 'ALOC', as recommended by Belbin (1995a) for datasets containing large numbers of objects (plots). ALOC was run with object-centroid distances calculated using the Bray and Curtis association measure, using the first plot as an initial seed, specifying an output of 200 initial groups and accepting the PATN default maximum number of iterations of *allocation -> centroid re-definition -> re-allocation*.

As outlined above, the classification dataset came from a variety of sources, and the data were known to contain survey-related variance factors with the potential to interfere with the clustering algorithm's recognition of 'real' floristic groups. These included varied plot sizes; some surveys with many records of coarse identification to genus level only (e.g. *Rytidosperma* spp.); different original species cover and abundance scoring systems used by some surveys; and irreconcilable taxonomic changes between old and recent surveys. For these and other reasons, the initial clustering output was considered likely to reflect both real (i.e. species' response to environmental gradients) and apparent (i.e. artefacts of survey method, disturbance etc.) patterns in species composition, and so the output of the automated free-ALOC clustering process was examined in detail.

The compositional attributes of each of the initial free-ALOC groups were examined by tabulating species frequencies and median cover scores using the FIDEL software developed by Bedward (1999). The homogeneity of each group was examined by computing a matrix of plot/centroid associations, and plotting in a GIS the spatial distribution of group members against mapped substrate, physiography and climate attributes. Graphical representations of group structure (dendrograms and ordinations of subset data) were

also examined in PRIMER v5 (Clarke & Gorley 2001). Relationships between free-ALOC groups and the groups identified by previous numerical classifications overlapping the study area (Benson & Jacobs 1994; Gellie 2005; McDougall & Walsh 2007; and Tozer *et al.* 2010) were also examined.

Individual plots with a weak association with the nearest centroid or anomalous spatial distribution were either reallocated to a 'near-neighbour' group supported by the above information, or excluded from further analysis if they could not be reliably assigned to any other floristic group and were not considered to represent a distinct new group. At a broader level, each of the initial groups were either retained (in some cases with minor reallocation into or out of the group), split into two or more separate groups, or merged with other groups. Groups were retained where a clear compositional dichotomy was associated with an environmental gradient. Merging was considered for groups that were:

- dominated by plots from single surveys or observers, with some consistent characteristic of that survey likely to blur true composition differences (e.g. distinctive cover-score systems, high frequency of genus-only records);
- seeded by disturbed plots, such as recently burnt or logged plots dominated by dense tree regrowth, or grazed TSR plots dominated by exotic pasture with very low native species richness and cover;
- seeded by or dominated by aberrant plots, which had been missed in the first series of data cleaning. This was commonly caused by either unusually large survey plots (most plots were 20 x 20 m; larger 20 x 50 m plots have a higher likelihood of containing more than one plant community or higher species richness), plots that contained suspiciously large species lists and may have been random meanders rather than plot-bounded surveys, and plots clearly representing sampling across an ecotone (such as boundaries between wetland perimeters and forest).

The eastern edge of the broader analysis area included a small number of plots representing the margins of moist coastal/escarpment plant community types, which had been classified as such by Tozer *et al.* (2010) in their coast/escarpment/eastern tablelands context. In the absence of their related plots outside the broader analysis area, the ALOC process tended to group these plots with moist tableland plots and blur the recognition of tableland groups. This was treated by accepting the Tozer *et al.* (2010) allocations of these moist coastal/escarpment plots, and excluding these groups when considering alternative allocations of tableland plots. This is further discussed below in *Relationship with previous classifications*.

A systematic examination of all initial free-ALOC groups and group assignments produced a revised allocation of all plots to groups (or identified plots for exclusion). This revised group definition was used to seed a subsequent round of ALOC clustering, involving both a zero-iteration run (to

examine the affinity of objects/plots to the revised groups) and a 10-iteration/0.8-radius run to test the stability of those groups and search for additional groups recognisable in the absence of outlier plots. The outputs of each iteration were again examined through ALOC tabulations of plot/centroid associations, group species frequency, cover and fidelity data (for non-grassland plots), comparison with previous study plot allocations, spatial distribution of plots, dendrograms etc., in order to further refine the definition of groups and the allocation of plots to those groups. This iterative process of refinement, re-run and checking continued until group membership was considered stable and a final allocation of plots to groups was accepted.

Plant ecologists familiar with the vegetation of the area were consulted during the analysis to gauge whether numerical data interpretations matched their perceptions of consistent floristic associations.

Grasslands of the South Eastern Highlands bioregion

Analysis of grassland floristic survey data within the South Eastern Highlands bioregion was carried out through a separate classification process described by Rehwinkel (unpublished). After various data cleaning operations, transformation of cover-abundance scores into a common system, and dealing with taxonomic consistency issues, field data from 437 grassland samples were analysed using the PATN software (Belbin 1995a, 1995b). Grassland classification followed the agglomerative hierarchical fusion strategy, using the Kulczynski measure of association and applying the flexible UPGMA formula with the default Beta value of -0.1. After multiple iterations run to explore the data and potential groups, a final analysis defined eight grassland plant communities (see Rehwinkel unpublished).

Relationship with previous classifications

Relationships between the communities identified by this study and communities identified by overlapping previous broad classifications (i.e. Benson & Jacobs 1994, Gellie 2005, McDougall & Walsh 2007 and Tozer *et al.* 2010) were explored by comparing the assignments of floristic plots to groups between current and previous group definitions. General relationships between the sampling density and classification scale of the current study and the previous broad regional classifications of Gellie (2005) and Tozer *et al.* (2010) were examined in each area of spatial overlap by comparing the numbers of plots classified and the number of separate groups (communities/assemblages) identified from those plots by each study.

Community descriptions

Plant communities identified in this study were labelled with an alpha-numeric code reflecting the dominant origin of that group's definition. Where a plant community corresponded closely with a group defined by a previous study, it was assigned a code reflecting this relationship:

- groups related to alpine communities identified by McDougall & Walsh (2007) are denoted by an 'a' for alps (note that some finer-scale closely related alpine groups were combined here; the code used for the resulting group was based on the original community considered to dominate the composite group);
- communities corresponding with map units described by Tozer *et al.* (2010) retained the alpha-numeric code assigned in that study (prefixes 'e', 'm' and 'p');
- groups closely matching the vegetation groups identified by Gellie (2005) are identified by 'g';
- tableland lake groups identified by Benson & Jacobs (1994) are denoted by 'L'; and
- grassland communities analysed and classified separately by Rehwinkel (unpublished) and described here are identified by an 'r' prefix.

Where an identified community had no clear relationship with any of the groups of previous regional classifications, its alpha-numeric code was prefaced by 'u'.

Plant communities were related to the hierarchy of NSW Structural Formations and Vegetation Classes of Keith (2004) based on their floristic and structural characteristics and the distribution of assigned plots.

Final groups of classified plots were used to characterise the properties of each community. Mean native species richness and cover were calculated from plots allocated to each community, and the vegetation structure of each community was described based on summaries of the structural variable estimates (height and cover for each stratum) recorded for plots within the dataset. The frequency of commonly-occurring weeds within each group was also identified from classified plots. The frequencies of weeds occurring in grasslands classified by Rehwinkel (unpublished) are not known as this separate analysis was undertaken in a dataset only containing native taxa.

Field data were used to generate lists of diagnostic plant taxa for each community and assist with identification in the field. The 'FIDEL' software developed by Bedward (1999) was used to calculate the frequency of each plant taxon within each group and in all other samples in the dataset. These frequency data were used to identify 'positive' and 'constant' diagnostic taxa for each community following the process developed by Tozer (2003) and described by Tozer *et al.* (2010). Positive diagnostic taxa were identified as those which occurred more frequently within a community than in other plant communities (i.e. a hypergeometric probability <0.001). Those taxa occurring with frequency <0.2 within the community and coefficient of variation >0.05 were excluded to minimise the inclusion of unreliable diagnostic taxa. Constant diagnostic taxa were identified as those which occur frequently in the community (>0.4) but also occur frequently in other groups.

Fidelity measures were not calculated for grassland plant communities of the South Eastern Highlands bioregion identified by Rehwinkel (unpublished) as these were

described through separate analysis. For these plant communities, cover/abundance and frequency information is presented.

The habitat or broad environmental domain of each community was described based on GIS intersects of plot locations against spatial environmental data including surface geology (DMR undated), soil landscapes (OEH unpublished b), modelled climate layers (Hutchinson 1989, Anon 2009), and topographic variables (altitude, slope, aspect) derived as part of this study from a 25 m grid digital elevation model (LPI 2006). This information was derived from across the broader analysis area, and in some cases augmented by the local knowledge of the authors. Additionally, each plant community contains tabulated summary information on the number of samples, mean species richness, slope, altitude, average annual rainfall and annual temperature range.

Nomenclature

Plant taxonomic nomenclature in this report follows the Australian Plant Census (ANBG 2011). Where the authors were aware of recent accepted taxonomic changes yet to be updated on the Australian Plant Census website, the latest nomenclature was used.

Naming of plant communities follows the format suggested by Benson (2006). For common names this includes one or more of the dominant / diagnostic plant species, the most prevalent structure and height class of upper stratum (based on Walker & Hopkins 1990), a reference to characteristic soil, substrate or climate, and reference to the main geographic occurrence of the plant community such as a location or bioregion. For community scientific names, up to 12 binomial scientific names of characteristic taxa are given, separated into up to three height strata. Alpine communities (i.e. plant communities with a prefix of 'a') are treated similarly, although ubiquitous taxa not aiding in plant community diagnosis are not included. Plant communities identified here are considered to fit within the 'association' level identified as Level V in Australia's NVIS hierarchy (ESCAVI 2003).

Results

Field survey and sample distribution

This study collected 319 new full-floristic survey plots. Of these, 270 survey plots targeted remnant woody vegetation within 29 Landscapes considered to have proportionally low existing sampling. A further 49 survey plots sampled vegetation or habitat types perceived to be under-sampled based on reviews of previous plant community classifications and expert knowledge of floristic datasets across the upper Murrumbidgee catchment and surrounds. This additional floristic information enabled greater refinement of floristic definitions for 44 of the 75 plant communities described within the upper Murrumbidgee catchment. Many of the plant communities such as lowland remnant woodland

and riparian shrubland communities are of limited extant distribution; the additional survey data increased the sampled distribution range of many plant communities. The surveys also increased sampling in 38 of the 49 Landscapes in the upper Murrumbidgee catchment.

The distribution of survey plots used in the analysis is shown in Figure 4, with Table 4 showing the sampling intensity of Landscapes prior to and after the additional survey. However, strong biases towards areas of public tenure remain and obvious coarse spatial sampling gaps remain on the Monaro plains, the lowlands of the ACT and areas north and west of Yass. Additionally, there are particular habitat types which remain undersampled, including riparian areas and small-scale wetlands.

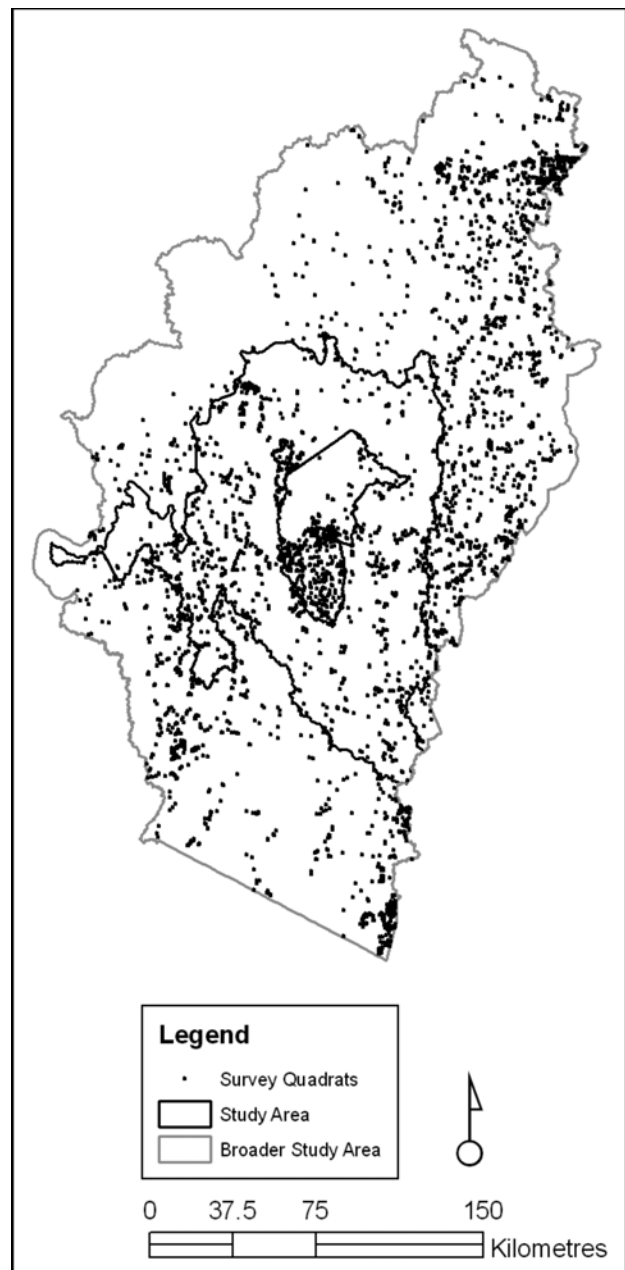


Fig. 4. Distribution of survey plots across the broader analysis area.

Table 4: Plot sampling intensities for each vegetated NSW Landscape within woody vegetation types in the upper Murrumbidgee catchment prior to (pre-study sampling) and collected as part of this study (revised sampling).

NSW Landscape	Area (ha) ¹	% vegetated ²	Pre-study sampling		Revised sampling		
			Previous no. of plots	Sampling intensity (ha/plot)	New plots (this study)	Revised total no. of plots	Revised sampling intensity (ha/plot)
Adelong Granite Ranges	21,067	18	6	632	1	7	542
Adrah Hills & Ranges	90,121	23	24	864	0	24	864
Alpine Zone	408	99	11	37	0	11	37
Bogong Montane	1,864	100	2	932	5	7	266
Boorowa Volcanics	74,271	10	10	743	13	23	323
Breadalbane Swamps & Lagoons	11,898	9	2	535	2	4	268
Burrinjuck Ridges	38,982	11	4	1,072	11	15	286
Cabramurra – Kiandra Basalt Caps & Sands	29,049	82	53	449	1	54	441
Canberra Plains	50,986	15	13	588	7	20	382
Carabost Hills & Ranges	16,182	29	1	4,693	0	1	4,693
Coolangubra – Good Good Plateau	164,400	77	118	1,073	6	124	1,021
Cootamundra – Tumut Serpentinite & Ultramafics	6,899	9	4	155	3	7	89
Cullarin Range Fault Block	18,474	31	0	nil	6	6	954
Dalton Hills	132,333	15	42	473	21	63	315
Doura Volcanics	232,494	55	232	551	11	243	526
Gourock – Tindery Ranges	23,753	96	36	633	5	41	556
Gourock – Tindery Slopes	131,114	73	108	886	15	123	778
Gundry Plains	98,550	28	45	613	9	54	511
Gunning Hills	20,299	6	3	406	0	3	406
Jagungal Tops	27,319	99	44	615	1	45	601
Jindabyne Plains	76,936	40	12	2,565	14	26	1,184
Jingera Valley	14,534	32	1	4,651	2	3	1,550
Kings Cross Montane	119,993	99	125	950	22	147	808
Kings Cross Sub-alpine	745	90	0	nil	0	nil	nil
Lake George Complex	46,789	9	7	602	7	14	301
Main Range Sub-alpine	22,951	92	6	3,519	10	16	1,320
Marilba Range	27,284	16	31	141	2	33	132
Minjary Hills & Ranges	70,801	39	52	531	3	55	502
Molonglo Channels & Floodplains	2,934	35	0	nil	6	6	171
Molonglo Ranges	134,740	55	96	772	22	118	628
Monaro Alluvium	2,931	26	0	nil	0	nil	nil
Monaro Lakes	428	32	8	17	0	8	17
Monaro Plains Basalts & Sands	96,295	34	31	1,056	1	32	1,023
Monaro Plains Granites	2,353	46	0	nil	4	4	271
Monaro Plains Meta-sediments	27,928	48	3	4,469	9	12	1,117
Mt Bundarbo Basalt Caps	4,760	28	4	333	0	4	333
Murrumbidgee – Tarcutta Channels & Floodplains	1,461	9	0	nil	1	1	132
Namadgi Range Alpine	14,739	100	53	278	0	53	278
Namadgi Range Montane	121,850	66	198	406	9	207	389
Namadgi Range Sub-alpine	74,816	98	170	431	1	171	429
Oberon – Kialla Granites	5,446	11	4	150	0	4	150
Pinbeyan – Ravine Ranges	28,500	94	14	1,914	17	31	864
Tantangara High Plains & Peaks	33,508	95	20	1,592	17	37	860
Tooma Granite Ranges	140,144	52	102	714	2	104	701
Upper Murrumbidgee Channels & Floodplains	9,598	5	0	nil	6	6	80
Upper Murrumbidgee Gorge	18,365	21	0	nil	8	8	482
Upper Murrumbidgee Valley	40,681	35	12	1,187	23	35	407
Yarrangobilly – Cooleman Karst	3,292	91	14	214	0	14	214
Young Hills & Slopes	100,710	9	34	267	14	48	189

¹ within upper Murrumbidgee catchment plus 10km buffer² Remnant vegetation (% remaining) for entire NSW Landscape. Source: OEH (unpub. a)

Data analysis

Floristic data collected from 4,106 field survey samples met the criteria for inclusion in the analysis. Of these, 738 samples (18%) were not assigned to a final group for various reasons: these were generally identified by high allocation radii (association value) from nearest group centroids, and on detailed inspection were found to include highly disturbed sites; ‘mixed’ plots including both riparian or wetland taxa and elements of adjacent drier habitats; samples which claimed to be plots but appeared to be random meander lists from a range of habitats with very high species richness; and plots from surveys using species-importance schema that did not transform well to the modified Braun-Blanquet cover-abundance scale used in this study. Grassland sites were not included in the final analysis as these had previously been analysed and classified by Rehwinkel (unpublished).

The remaining 3,368 field samples were assigned to 145 vegetation groups or plant communities across the broader analysis area. Of these, 67 plant communities were recorded within the upper Murrumbidgee catchment or considered likely to occur there. An additional eight grassland communities were identified through the process described by Rehwinkel (unpublished). These 75 plant communities are listed in Table 6 and described in Appendix 1. Coarse floristic relationships between the plant communities identified in this study are indicated by the dendrogram (Figure 5).

Specific relationships between the plant communities identified by this study and those identified by previous numerical classifications (Benson & Jacobs 1994, Gellie 2005, McDougall & Walsh 2007 and Tozer *et al.* 2010) were explored by comparing the assignments of sites to groups between the current study and these previous classifications. The table in Appendix 2 indicates the strongest relationships identified between current and previous classification groups.

The upper Murrumbidgee catchment area overlaps to different extents the classification studies of Gellie (2005) and Tozer *et al.* (2010) and general relationships between the plot clusters identified by this study and the earlier regional classifications were examined. In areas of overlap, the current study utilised all of the field survey plots classified by these previous studies as well as additional recent survey data. The number of groups identified from field survey plots shared by the current and earlier works indicates that Gellie

(2005) identified groups at a finer classification scale than the current project [895 shared sites allocated to 75 groups by Gellie (2005) and 67 groups by the current study], while classification by Tozer *et al.* (2010) was at a similar scale to that of the current study (44 shared sites into 13 groups versus 14 groups in the current study). The current study classified an additional 683 field survey plots in the area of overlap with Gellie (2005) and an additional 29 plots in the area of overlap with Tozer *et al.* (2010) (Table 5).

Vegetation distribution

The 75 plant communities identified by numerical analysis from the upper Murrumbidgee catchment [including grasslands identified by Rehwinkel (unpublished)] occur across 18 of the NSW Vegetation Classes within nine of the Structural Formations described by Keith (2004) (Table 6). The sampled distribution of plant communities within each Structural Formation is shown in Figure 6 (refer to Appendix 1 for sampled distribution of each plant community).

Plant communities within the *Alpine Complex* Formation are distributed primarily in higher parts of the Australian Alps bioregion, although there are examples of these communities within montane environments in adjacent areas of the South Eastern Highlands. *Rainforests*, while defined from plots outside of the upper Murrumbidgee catchment, are known to occur in the Bogong Peaks Wilderness Area (Greening Australia 2011). *Wet sclerophyll forests* are generally found in the Brindabella, Namadgi and western fall of the main Kosciuszko range areas in the west, the Tallaganda ranges in the east, and in between at Tinderry NR where a variety of taxa characteristic of both eastern and western wet sclerophyll environments occur. *Dry sclerophyll forests* occur on relatively infertile exposed hills and slopes across most of the study area exclusive of the Kosciuszko main range. *Heathlands* are found on exposed ridges in Dangelong NR in the southeast of the upper Murrumbidgee catchment, and may occur in similar locations. *Forested wetlands* occur primarily on major water courses as narrow remnants on alluvial plains, or surrounded by dry sclerophyll forests in riverine gorges. *Freshwater wetlands* occur in depressions of variable size across the Monaro and in montane areas as bogs and fens. *Grassy woodlands* generally occur as degraded remnants across much of the upper Murrumbidgee catchment (exclusive of the Monaro rain shadow grassland and treeless alpine areas), as small remnants across the highly cleared

Table 5: Comparison of site availability and classification scale in areas of overlap between the upper Murrumbidgee catchment and those of Gellie (2005) and Tozer *et al.* (2010).

Previous Study	Area shared with current study area (ha)	Number of sites classified in this study shared with previous study	Number of groups to which those sites were allocated by each previous study	Number of groups to which those sites were allocated by the current study	Number of sites classified in this shared area by the current study	Number of groups to which those sites were allocated by the current study
Gellie (2005)	1,817,000	932 sites	77 groups	43 groups	1627 sites	68 groups
Tozer <i>et al.</i> (2010)	258,000	75 sites	14 groups	16 groups	155 sites	23 groups

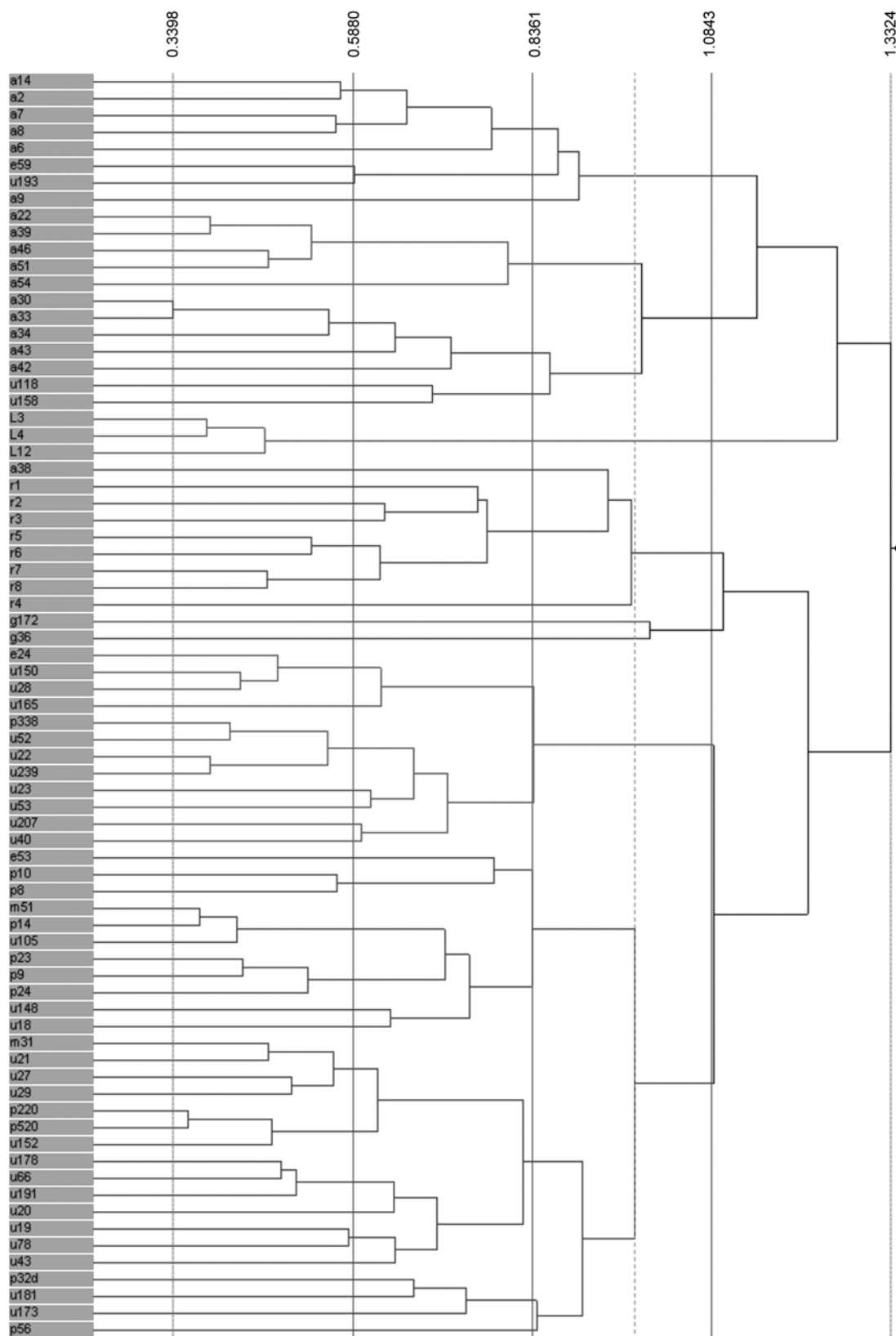


Fig. 5. Dendrogram showing hierarchical relationships between 75 vegetation communities of the upper Murrumbidgee catchment identified from analysis of quantitative survey plot data.

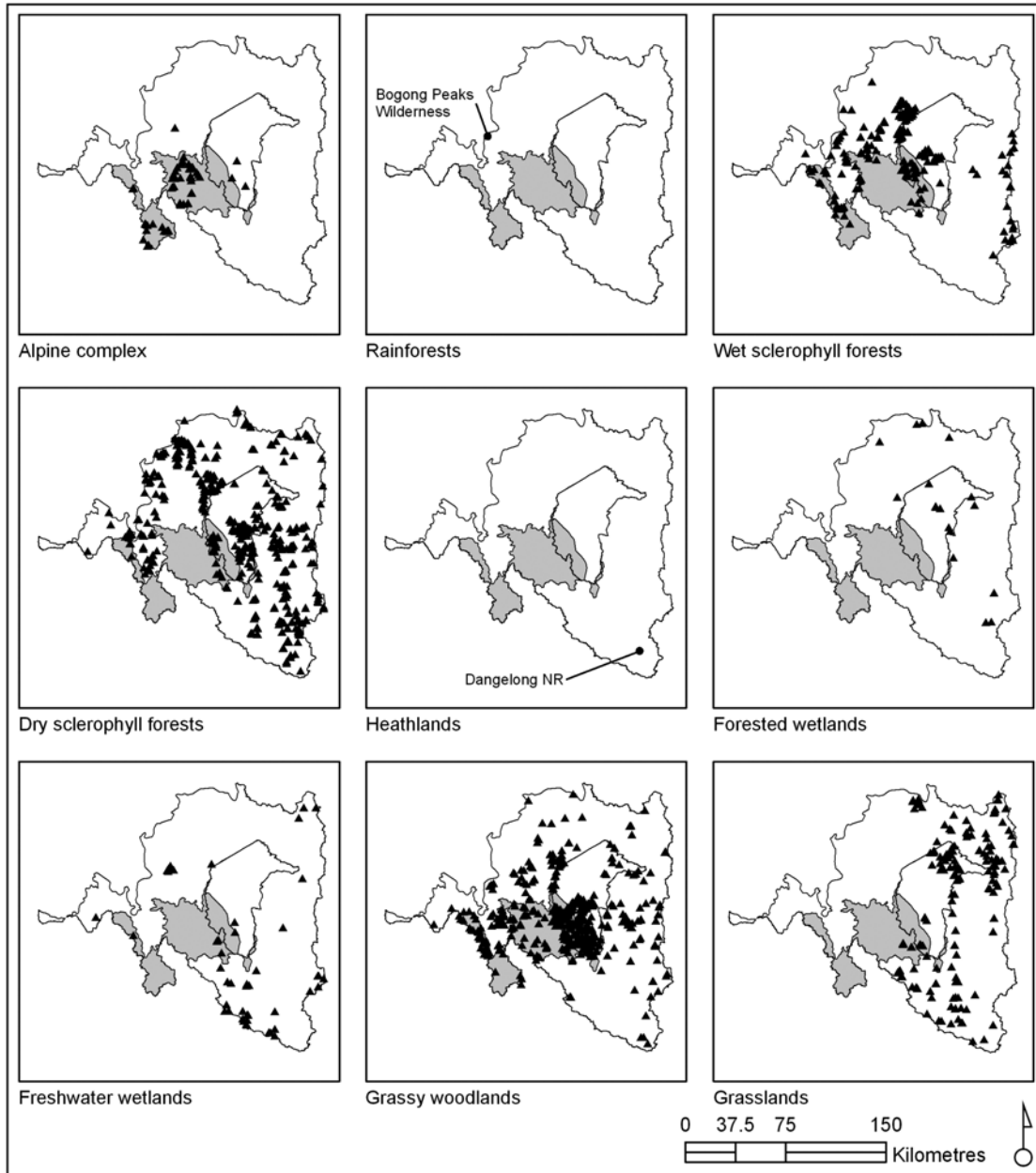


Fig. 6. Distribution of plots occurring within the upper Murrumbidgee catchment area assigned to plant communities in each Structural Formation [Known (rather than sampled) distribution of Rainforest and Heathland also shown; Australian Alps bioregion shaded].

Monaro and Murrumbateman subregions and as patches amongst wet or dry sclerophyll forests. *Grasslands* are known primarily from valleys and depressions influenced by cold air drainage prohibiting tree growth, and on open basalt plains of the Monaro.

Threatened Ecological Communities

Of the 75 plant communities listed in Table 6, four have affinities with Threatened Ecological Communities (TECs) currently listed under the EPBC Act 1999, three with communities listed on schedules of the TSC Act 1995, and two declared under the NC Act 1980 (Table 7).

Discussion

Factors guiding the distribution of plant communities

While producing a vegetation map was beyond the scope of this study, the distribution of plot data provides an indicative distribution of plant communities in the upper Murrumbidgee catchment and surrounds (Figure 6; refer to maps in Appendix 1 for sampled distribution of individual plant communities). The distribution of Structural Formations is generally guided by strong variation in climate (precipitation, temperature and wind), topographic relief (altitude, slope and aspect) and broad lithology. Within each Formation, plant communities are distributed based on finer scale variations of these, along with changes in soil fertility, acidity, frost persistence, water

retention and humification. Where relevant, the descriptions of individual plant communities in Appendix 1 include discussion of environmental factors considered likely to be influencing distribution.

Non-floristic factors which may influence vegetation classification

The ability of analytical processes (such as clustering algorithms) to identify recurring plant associations at a consistent classification level can be influenced by variable density or bias in sampling intensity (see Bell 2013), survey timing (e.g. season and precedent wet/dry conditions), sampling effort, species misidentifications and estimation of cover-abundance (see discussion by Tozer et al. 2010). The influence of these factors is potentially greatest when particular areas or habitat types are only sampled by one survey or surveyor and there is no alternative source of field data. As outlined in the *Results* section, data lineage and potential bias was considered throughout the analysis to ensure plant communities were not defined based on sampling artefacts. Nevertheless, we have identified some plant communities that are defined primarily on the basis of a single survey. Generally, these plant communities occupy ecological niches subject to specific studies such as treeless alpine areas or wetlands of the Monaro. Three woodland/forest plant communities were also identified on the basis of one survey: u20: *Kurrajong – Bursaria spinosa – Themeda australis shrub-grass mid-high open woodland on limestone karsts in the Wee Jasper area*; u66: *Mealy Bundy – Red Stringybark grass-herb mid-high open forest of the South Eastern Highlands and Upper Slopes Subregion of the South Western Slopes bioregion*; and u191: *Black Cypress Pine – Brittle Gum tall dry open forest on hills primarily in the Cooma region*. Each of these plant communities was identified through data collected in poorly sampled landscapes and dominated by a distinct suite of taxa not characteristic of other plant communities within the broader analysis area. We believe these plant communities are sound but more widespread sampling in similar vegetation will be useful to confirm this and better define relationships with other plant communities.

Numerical classification of plant communities relies on survey plots distributed across the environmental domains considered to govern plant distributions. Plant communities which occur in domains primarily distributed outside a study area may be poorly described, or remain unrecognised, as their full range of variation has not been sampled. For this reason, it is appropriate for vegetation classification studies to include a buffer beyond the study area boundary and include plot samples that assist in adequately identifying and describing such plant communities by incorporating data from across their full environmental domain. In the current study of the upper Murrumbidgee catchment area classification being based on samples from a much larger area of interest, the “broader analysis area” (covering the NSW sections of the Australian Alps and South East Highlands bioregions, from the Victorian border north to the Oberon shire, and the Boorowa Shire). This broader analysis

area allowed exploration of relationships between plant communities in the upper Murrumbidgee catchment and the bioregions that it sits within, ensuring that plant communities defined in the upper Murrumbidgee catchment fit within a broader bioregional context.

Differentiation between natural plant communities may also be blurred by widespread disturbance in sampled vegetation, an effect which may be stronger in some plant communities than others. In native vegetation remnants on the tablelands of NSW, for example, disturbance associated with grazing (including selective removal of more durable-timbered tree species, long exclusion of fire, increased soil nitrogen, loss of palatable understorey taxa, invasion by exotic plants and selective grazing of more palatable herbs) (e.g. see Leigh & Holgate 1979; Prober & Thiele 2005) may lead to simplification of structure and composition and consequent blurring of floristic differences between related plant communities. In the current study, plant communities associated with landscapes of high to moderate agricultural suitability are likely to be most prone to classification blurring, such as vegetation of moist alluvium, grassy woodlands and grasslands of undulating tableland and slopes landscapes.

The ability of numerical classification to identify plant associations at a consistent classification level can also be influenced by plot size. Otýpková & Chytrý (2006) found that variation in plot size affected the ability of ordination techniques to identify stable groups and potentially distorted plant community group clustering in ordination. Two plots sampling the same plant community with widely different plot sizes may have reduced association or similarity values simply because a larger plot may include taxa absent from the smaller plot. The effect of plot size on ordination was not tested as part of this study, rather floristic information was reviewed to exclude plots that were considered unusual (e.g. likely to be sampling across an ecotone or collected through random-meander). Plot size could be dictated at a Structural Formation classification level (or a similar broad classification) to guide appropriate plot size relative to functions of scale and floristic variation. For example, McDougall (1978) found that a plot size of 8 m² was sufficient to capture 95% of species in a diverse open heathland on the Bogong High Plains in the Australian Alps bioregion in Victoria. Neldner & Butler (2009) suggest that, in Queensland, the rate of new species being encountered in rainforests did not decline until about 2,000 m² had been sampled.

In the present study, variable plot size was potentially a strong influence in the identification of tableland lake plant communities. The majority of samples from this habitat available to the present study (65 out of 76) were whole-lake samples by Benson & Jacobs (1994), recording all plant taxa from both the strandline margin and standing water of each lake surveyed. Lakes ranged in size from less than 1 ha up to 215 ha, with a median size of over 5 ha. In contrast, the 11 more recent lake samples involved 0.04 ha plots, generally located in standing water parts of wetlands. In the cluster analysis, the Monaro lake samples showed a clear tendency

Table 6: Plant communities occurring in the upper Murrumbidgee catchment area, and their relationship with the Vegetation Classes and Structural Formations of Keith (2004).**ALPINE COMPLEX****Class: Alpine Herbfields**

a6: *Ranunculus millanii* – *Pratia surrepens* – *Carex gaudichaudiana* herbfield of shallow depressions in the Australian Alps bioregion

a14: *Poa costiniana* – *Carex gaudichaudiana* subalpine valley grassland of the Australian Alps bioregion

a22: *Poa fawcettiae* – *Celmisia costiniana* – *Craspedia maxgrayi* grassland of the Australian Alps bioregion

a30: *Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion

a38: *Themeda australis* – *Galium roddii* – *Leucochrysum alpinum* grassland of steep limestone slopes in the Australian Alps bioregion

Class: Alpine Heaths

a33: *Bossiaea foliosa* – *Cassinia monticola* – *Kunzea muelleri* – *Hovea montana* heathland of the Australian Alps bioregion

a39: *Epacris* sp. – *Pentachondra pumila* – *Poa fawcettiae* heathland of the Australian Alps bioregion

a42: *Epacris celata* – *Poa clivicola* – *Dillwynia palustris* grassy heathland of the Australian Alps bioregion

a43: *Bossiaea riparia* – *Themeda australis* low open heathland of the Australian Alps bioregion

a46: *Prostanthera cuneata* – *Orites lancifolius* – *Nematolepis ovatifolia* heathland of the Australian Alps bioregion

a51: *Podocarpus lawrencei* – *Rytidosperma alpicola* – *Brachyscome nivalis* low open heathland of rock outcrops of the Australian Alps bioregion

a54: *Podocarpus lawrencei* – *Pimelea ligustrina* subsp. *ciliata* heathland of screes and boulder-fields of the Australian Alps bioregion

g36: *Leptospermum micromyrtus* – *Kunzea muelleri* – *Kunzea ericoides* dry heathland on skeletal ridges primarily of the Namadgi region

Class: Alpine Bogs and Fens

a2: *Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)

a7: *Ranunculus pimpinellifolius* – *Gonocarpus micranthus* herbfield of wetland margins in the Australian Alps bioregion

a8: *Carex gaudichaudiana* – *Myriophyllum pedunculatum* – *Deschampsia cespitosa* sedge-land of the Australian Alps bioregion (Fen)

RAINFORESTS**Class: Cool Temperate Rainforests**

g172: Black Sassafras temperate rainforest of wet sheltered slopes in the Australian Alps and Bondo subregion of the South Eastern Highlands bioregions

WET SCLEROPHYLL FORESTS**Class: Montane Wet Sclerophyll Forests**

u40: Alpine Ash very tall wet sclerophyll open forest primarily of the Australian Alps bioregion

u53: Mountain Gum – Blackwood tall wet sclerophyll open forest primarily on granitoids of the Australian Alps and western South Eastern Highlands bioregions

u239: Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions

Class: Southern Tableland Wet Sclerophyll Forests

u52: Ribbon Gum – Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo subregion of the South Eastern Highlands and the northern Australian Alps bioregions

Class: Southern Escarpment Wet Sclerophyll Forests

p338: Brown Barrel wet sclerophyll very tall grass-herb open forest primarily of the Gourock and Tallaganda Ranges in the South Eastern Highlands bioregion

DRY SCLEROPHYLL FORESTS

Class: Southern Tableland Dry Sclerophyll Forests

- e24:** Mountain Gum – Snow Gum very tall dry shrubby open forest primarily in the Kybeyan – Gourock subregion of the South Eastern Highlands bioregion
- m31:** Ribbon Gum – Snow Gum – *Cassinia longifolia* tall shrub-grass open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands bioregion
- m51:** Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll open forest on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan – Gourock subregions of the South Eastern Highlands bioregion
- p8:** Silvertop Ash – Narrow-leaved Peppermint shrubby tall dry open forest primarily on sedimentary ridges of the eastern South Eastern Highlands bioregion
- p10:** Black She-oak – Silvertop Ash tall shrubby dry sclerophyll open forest primarily in the Bungonia subregion of the South Eastern Highlands bioregion
- p9:** Brittle Gum – Scribbly Gum shrubby tall dry open forest on infertile low ridges and hills primarily of the Bungonia subregion of the South Eastern Highlands bioregion
- p14:** Red Stringybark – Scribbly Gum – *Rytidosperma pallidum* tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion
- p23:** Red Stringybark – Broad-leaved Peppermint tall dry sclerophyll grassy open forest on loamy rises primarily in the Bungonia subregion of the South Eastern Highlands bioregion
- u18:** Mealy Bundy – Broad-leaved Peppermint shrubby mid-high open forest on granite substrates primarily in the South Eastern Highlands
- u21:** Broad-leaved Peppermint – Candlebark tall dry sclerophyll open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps bioregions
- u29:** Apple Box – Broad-leaved Peppermint tall shrub-grass open forest primarily on granitoids of the South Eastern Highlands bioregion
- u105:** Broad-leaved Peppermint – Brittle Gum – Red Stringybark tall shrub-grass dry sclerophyll open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes bioregions
- u148:** Red Stringybark – Red Box grass-forb tall open forest of the upper South Western Slopes and western South Eastern Highlands bioregions
- u150:** Broad-leaved Peppermint – Mountain Gum shrubby tall open forest of the South Eastern Highlands and Australian Alps bioregions
- u152:** Robertson's Peppermint – Red Stringybark very tall grass-forb sheltered open forest of the southwest South Eastern Highlands and upper South Western Slopes bioregions
- u165:** Robertson's Peppermint very tall shrubby open forest primarily of the Bondo subregion of the South Eastern Highlands bioregion
- u191:** Black Cypress Pine – Brittle Gum tall dry open forest on hills primarily in the Cooma region

Class: Upper Riverina Dry Sclerophyll Forests

- u43:** Mealy Bundy – *Acacia implexa* – *Allocasuarina verticillata* – *Ricinocarpos bowmanii* tall grassy open woodland on serpentinite in the Coolac-Goobarragandra area primarily of the upper South Western Slopes bioregion
- u66:** Mealy Bundy – Red Stringybark grass-forb mid-high open forest of the South Eastern Highlands and Upper Slopes Subregion of the South Western Slopes bioregion

HEATHLANDS

Class: Southern Montane Heaths

- e53:** *Allocasuarina nana* shrubland on exposed skeletal ridges of primarily in the eastern South Eastern Highlands bioregion

FORESTED WETLANDS

Class: Eastern Riverine Forests

- p32d:** River She-oak riparian forest on sand/gravel alluvial soils along major watercourses of the South Eastern Highlands and upper South Western Slopes bioregions
- p56:** *Leptospermum grandifolium* – *Hakea microcarpa* – *Lomatia myricoides* riparian very tall shrubland of the eastern South Eastern Highlands bioregion
- u181:** *Callistemon sieberi* – *Kunzea ericoides* rocky riparian tall shrubland in the South Eastern Highlands and upper South Western Slopes bioregions

FRESHWATER WETLANDS**Class: Inland Riverine Forests**

u173: River Red Gum ± Apple Box very tall grass-forb riparian woodland on alluvial flats in the South Eastern Highlands and upper South Western Slopes bioregions

Class: Montane Bogs and Fens

a9: *Carex gaudichaudiana* – *Ranunculus amphitrichus* – *Phragmites australis* aquatic herbfield of waterways in the Australian Alps and South Eastern Highlands bioregions

e59: *Hakea microcarpa* – *Baeckea utilis* – *Leptospermum myrtifolium* subalpine wet heathland on escarpment and eastern tableland ranges of the South Eastern Highlands bioregion

u193: *Hakea microcarpa* – *Epacris breviflora* – *Epacris paludosa* subalpine wet heathland of the Australian Alps and western South Eastern Highlands bioregions

Class: Montane Lakes

L12: Freshwater sedge-herb marsh of shallow, commonly inundated wetlands of the eastern South Eastern Highlands bioregion

L3: Freshwater sedge-herb marsh of shallow ephemeral lakes of the eastern South Eastern Highlands bioregion

L4: Freshwater sedge-herb marsh of deep semi-permanent and/or slightly saline wetlands of the eastern South Eastern Highlands bioregion

GRASSY WOODLANDS**Class: Subalpine Woodlands**

a34: Weeping Snow Gum shrub-grass open woodland of the Australian Alps bioregion

u22: Mountain Gum – Snow Gum ± Robertson's Peppermint grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions

u23: Snow Gum – Drumstick Heath – *Leptospermum myrtifolium* tall woodland to open forest of drainage depressions primarily of the South Eastern Highlands bioregion

u27: Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion

u28: Snow Gum – Mountain Gum – *Daviesia mimosoides* tall dry grass-shrub subalpine open forest of the Australian Alps and South Eastern Highlands bioregions

u118: Black Sallee grass-herb woodland in drainage depressions and moist valley flats in the South Eastern Highlands and Australian Alps bioregions

u158: Alpine Sallee shrub-grass subalpine mid-high woodland of the Australian Alps bioregion

u207: Jounama Snow Gum – Snow Gum shrubby mid-high woodland on granitoids primarily of the Namadgi region

Class: Southern Tableland Grassy Woodlands

p24: Yellow Box – Blakely's Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands bioregion

u19: Blakely's Red Gum – Yellow Box ± White Box tall grassy woodland of the Upper South Western Slopes and western South Eastern Highlands bioregions

u20: Kurrajong – *Bursaria spinosa* – *Themeda australis* shrub-grass mid-high open woodland on limestone karsts in the Wee Jasper area

u178: Yellow Box ± Apple Box tall grassy woodland of the South Eastern Highlands bioregion

Class: Tableland Clay Grassy Woodlands

p220: Ribbon Gum – Snow Gum tableland flats tall grassy woodland primarily on granitoids in the Kybean – Gourock and Monaro subregions of the South Eastern Highlands bioregion

p520: Ribbon Gum very tall woodland on alluvial soils along drainage lines of the eastern South Eastern Highlands bioregion

u78: Snow Gum grassy mid-high woodland of the South Eastern Highlands bioregion

Class: Temperate Montane Grasslands

r1: Sub-montane moist tussock grassland of the South Eastern Highlands bioregion

r2: *Poa labillardierei* – *Themeda australis* – *Juncus* sp. wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion

r3: *Rytidosperma* sp. – *Themeda australis* – *Juncus* sp. tussock grassland of occasionally wet sites of the South Eastern Highlands bioregion

r4: Lacustrine Grass-forbland of the South Eastern Highlands bioregion

r5: *Rytidosperma* sp. – *Austrostipa bigeniculata* – *Chrysocephalum apiculatum* tussock grassland of the South Eastern Highlands bioregion

r6: Dry tussock grassland of the Monaro in the South Eastern Highlands bioregion

r7: *Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* moist tussock grassland of the South Eastern Highlands bioregion

r8: *Themeda australis* – *Lomandra filiformis* – *Aristida ramosa* dry tussock grassland in the South Eastern Highlands bioregion

to form three main groups identified by Benson & Jacobs (1994), with minor shifts in group membership. The newer 0.04 ha plot samples showed a moderate tendency to join the larger Monaro groups; as there were no strong differences in elevation, substrate or other factors to justify a separation between the wetland vegetation sampled by newer plots and the Monaro whole-lake wetland samples, the plot samples were assigned to the Monaro groups. Further sampling and clarification of tableland lake communities using a consistent set of methods is desirable, particularly as larger lake systems with variable water depth may contain more than one plant community.

Relationships with overlapping previous regional classifications

Based on comparisons of group memberships, the plant communities identified by the current study show varying relationships with groups identified by previous studies (Appendix 2). The treeless alpine plant communities identified by McDougall & Walsh (2007) are largely retained in the current study, with some merging of related types reflecting a somewhat broader classification scale applied by the current study, and the absence of Victorian plots in the analysis. The tableland lake communities identified by Benson & Jacobs (1994) are also essentially retained, with two highly similar types merged. Many of the plant communities identified in the east of the current study area have clear relationships with the associations identified by Tozer *et al.* (2010), however some are described in the context of the broader analysis area based on inclusion of a larger pool of tableland samples than was available to that study, and to some extent, a different study area context. In the central and western parts of the upper Murrumbidgee catchment, relationships between plant communities of the current study and the vegetation groups of Gellie (2005) are far more complex, with few close equivalents. This different relationship may be attributable to the different classification

scales adopted, and to the significant additional field survey data available to the current study both within areas of overlap and extending beyond previous study boundaries (see Table 5).

The reader should be aware that two communities with the same identifier in different classifications may have a different diagnostic species list in each. This may be caused by the additional plots available to the current study or differences in study area boundaries. For instance, plant community p14 in the current classification contains 101 of 154 plots used by Tozer *et al.* (2010) to define map unit p14 in that study, and an additional 64 plots that were not used in the original classification. Map unit p14 as defined by Tozer *et al.* (2010) and p14 as described in this study are likely to be equivalent, given the dominance of plots used in the initial classification and the similarity in diagnostic species. Similarly, Community p520 as described in Tozer *et al.* (2010), while considered equivalent to p520 in this study, contains a higher frequency of *Eucalyptus pauciflora* ssp. *pauciflora*, with less *Eucalyptus stellulata*.

The effect of spatial context is especially strong when considering plant communities occurring on the edge of the broader analysis area. For example, the broader analysis area of the current study overlaps the study area of Tozer *et al.* (2010) to the east and north, and a number of eastern escarpment and central tablelands vegetation types identified by that study are peripheral to the broader analysis area, with just a small portion of their distribution overlapping. Of the 30 field samples allocated to map unit e11 [*Tantawangalo Wet Shrub Forest*] by Tozer *et al.* (2010), only one was in the broader analysis area; of 131 samples of p40 [*Temperate Dry Rainforest*], three were in the broader analysis area; and of 125 samples allocated by Tozer *et al.* (2010) to p144 [*Wingecarribee-Burraborang Sandstone Forest*], only two were in the broader analysis area. Where the majority of an original group's membership was outside the broader analysis area, samples were automatically allocated to the

Table 7: Relationships between plant communities described in this study and Threatened Ecological Communities under Commonwealth, NSW and ACT legislation.

Threatened Ecological Community	Legislation	Plant community
Alpine Sphagnum Bogs and Associated Fens	EPBC Act 1999	a2, a8
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	TSC Act 1995	a2, a7, a8, e59, u193
Natural Temperate Grassland	NC Act 1980	r1, r2, r3, r5, r7, r8
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	EPBC Act 1999	r1, r2, r3, r4, r5, r6, r6, r8
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions	TSC Act 1995	u27, u118, p220, p520, u78 (all); e24, m31, u21, u22, u23, u28 (may contain)
Upland Wetlands of the New England Tablelands and the Monaro Plateau	EPBC Act 1999	L12, L3, L4
White Box Yellow Box Blakely's Red Gum Woodland	TSC Act 1995	p24, u19, u178 (all); p23, u20 (may contain)
White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland	EPBC Act 1999	p24, u19, u178 (all); p23, u20 (may contain)
Yellow Box/Red Gum Grassy Woodland	NC Act 1980	r178, u19

group identified by Tozer *et al.* (2010). However, none of these plant communities occur in the upper Murrumbidgee catchment.

The large number of endemic species in plant communities in the Australian Alps means that diagnostic taxa may be identified for these communities simply because they do not occur in non-Alps communities. The diagnostic taxa are therefore useful for distinguishing Alps communities from non-Alps communities but not necessarily for distinguishing Alps communities from each other. We suggest that users attempting to identify Alps communities place less value on species that are diagnostic in many Alps communities (e.g. *Carex gaudichaudiana*, *Poa costiniana*, *Grevillea australis*) and make decisions based on the presence of many taxa from the diagnostic species list.

The diagnostic species lists in this paper will aid plant community identification within the upper Murrumbidgee catchment but should not be used to identify the same communities beyond. When a seamless plant community classification is produced for NSW, the floristic character of the resulting communities, which will be based on all available data and their entire extent, may be subtly different from the current and previous classifications.

The method for identifying diagnostic taxa in this study has been used in several plant community classifications in NSW. Experience from this study suggests that development of a less context-sensitive measure of fidelity (the basis for the identification of diagnostic taxa), is desirable for large regional classifications. Alternative metrics are presented by De Cáceres *et al.* (2008).

Threats to plant communities

Whilst legislation [e.g. *Native Vegetation Act 2003* (NSW) and the *Planning and Development Act 2007*(ACT)] has reduced the threat of broad scale clearing in NSW and the ACT, many of the plant communities described in this study are subject to ongoing threats. Land-clearing, stock and feral herbivore grazing, weed invasion, altered hydrology, climate change and alteration of fire regimes continue to significantly reduced the distribution, floristic integrity and genetic variability of vegetation across the landscape (Keith & Auld 2009). This is evident in the majority of plant communities within the upper Murrumbidgee catchment, and perhaps more so in *Grassy Woodlands*, *Grasslands*, *Forested Wetlands* and *Freshwater Wetlands* Formations occurring in highly altered landscapes at lower elevations. Many *Dry Sclerophyll Forests*, *Wet Sclerophyll Forests* and *Heathlands* are relatively well protected in the formal reserve system or managed on Forests NSW estate. Plant communities in the *Alpine Complex* are, for the most part, well protected in the formal reserve system. However, even in the Alps, changes in vegetation distribution and functionality are likely to occur due to increased temperatures, decreased precipitation and decreased duration of snow cover related to anthropogenic climate change (Pickering & Armstrong 2003). *Rainforests*, while formally reserved and small in extent, need to be protected from extreme fire events. The scale of threat to all

plant communities identified in this study and the adequacy of protection can only be assessed once mapping and detailed threat analysis has been completed.

Nine Threatened Ecological Communities (TEC) under Commonwealth, NSW and ACT legislation occur in the upper Murrumbidgee catchment (Table 7). This study has also identified five additional plant communities which are highly restricted in distribution and may require active management or protection to ensure their survival. Community g172 [*Black Sassafras temperate rainforest of wet sheltered slopes in the Australian Alps and Bondo subregion of the South Eastern Highlands bioregions*] is found in isolated patches along creeks in the Bogong Peaks wilderness area, Geehi Valley, and Jacobs and Pinch River Gorges. It occurs in small and potentially genetically isolated patches which, to date, have escaped severe wildfires (Doherty *et al.* 2011, Greening Australia 2011). Community u20 [*Kurrajong – Bursaria spinosa – Themeda australis shrub-grass mid-high open woodland on limestone karsts in the Wee Jasper area*] is highly restricted, believed to have approximately 10 ha remaining and contains a number of threatened and unusual plant taxa. Community u43 [*Mealy Bundy – Acacia implexa – Allocasuarina verticillata – Ricinocarpos bowmanii tall grassy open woodland on serpentinite in the Coolac–Goobarragandra area primarily of the upper South Western Slopes bioregion*] is restricted in distribution, and is highly fragmented with little recruitment of woody species observed within sampled areas. Community u173 [*River Red Gum ± Apple Box very tall grass-forb riparian woodland on alluvial flats in the South Eastern Highlands and upper South Western Slopes bioregions*] occurs on fertile alluvial flats adjacent to major rivers and has been extensively cleared, with isolated remnants commonly degraded by grazing and weed invasion. Community a54 [*Podocarpus lawrencei – Pimelea ligustrina subsp. ciliata heathland of screes and boulder-fields of the Australian Alps bioregion*] is highly restricted and the primary habitat of the endangered Mountain Pygmy Possum. Most examples of community a54 in NSW were burnt in 2003, with the dominant species of this species-poor community (*Podocarpus lawrencei*) sensitive to fire (McDougall *et al.* 2012), potentially taking a decade or more to be reproductive. These communities should be assessed for eligibility for protection under State and/or Commonwealth legislation.

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Appendix 1: Plant community type descriptions for plant communities occurring in the upper Murrumbidgee catchment area.

List of Contents

ALPINE COMPLEX

Class: Alpine Herbfields

a6: *Ranunculus millanii* – *Pratia surrepens* – *Carex gaudichaudiana* herbfield of shallow depressions in the Australian Alps bioregion

a14: *Poa costiniana* – *Carex gaudichaudiana* subalpine valley grassland of the Australian Alps bioregion

a22: *Poa fawcettiae* – *Celmisia costiniana* – *Craspedia maxgrayi* grassland of the Australian Alps bioregion

a30: *Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion

a38: *Themeda australis* – *Galium roddii* – *Leucochrysum alpinum* grassland of steep limestone slopes in the Australian Alps bioregion

Class: Alpine Heaths

a33: *Bossiaea foliosa* – *Cassinia monticola* – *Kunzea muelleri* – *Hovea montana* heathland of the Australian Alps bioregion

a39: *Epacris* sp. – *Pentachondra pumila* – *Poa fawcettiae* heathland of the Australian Alps bioregion

a42: *Epacris celata* – *Poa clivicola* – *Dillwynia palustris* grassy heathland of the Australian Alps bioregion

a43: *Bossiaea riparia* – *Themeda australis* low open heathland of the Australian Alps bioregion

a46: *Prostanthera cuneata* – *Orites lancifolius* – *Nematolepis ovatifolia* heathland of the Australian Alps bioregion

a51: *Podocarpus lawrencei* – *Rytidosperma alpicola* – *Brachyscome nivalis* low open heathland of rock outcrops of the Australian Alps bioregion

a54: *Podocarpus lawrencei* – *Pimelea ligustrina* subsp. *ciliata* heathland of screes and boulder-fields of the Australian Alps bioregion

g36: *Leptospermum micromyrtus* – *Kunzea muelleri* – *Kunzea ericoides* dry heathland on skeletal ridges primarily of the Namadgi region

Class: Alpine Bogs and Fens

a2: *Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)

a7: *Ranunculus pimpinellifolius* – *Gonocarpus micranthus* herbfield of wetland margins in the Australian Alps bioregion

a8: *Carex gaudichaudiana* – *Myriophyllum pedunculatum* – *Deschampsia cespitosa* sedgeland of the Australian Alps bioregion (Fen)

RAINFORESTS

Class: Cool Temperate Rainforests

g172: Black Sassafras temperate rainforest of wet sheltered slopes in the Australian Alps and Bondo subregion of the South Eastern Highlands bioregions

WET SCLEROPHYLL FORESTS

Class: Montane Wet Sclerophyll Forests

u40: Alpine Ash very tall wet sclerophyll open forest primarily of the Australian Alps bioregion

u53: Mountain Gum – Blackwood tall wet sclerophyll open forest primarily on granitoids of the Australian Alps and western South Eastern Highlands bioregions

u239: Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions

Class: Southern Tableland Wet Sclerophyll Forests

u52: Ribbon Gum – Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo subregion of the South Eastern Highlands and the northern Australian Alps bioregions

Class: Southern Escarpment Wet Sclerophyll Forests

p338: Brown Barrel wet sclerophyll very tall grass-herb open forest primarily of the Gourock and Tallaganda Ranges in the South Eastern Highlands bioregion

DRY SCLEROPHYLL FORESTS**Class: Southern Tableland Dry Sclerophyll Forests**

e24: Mountain Gum – Snow Gum very tall dry shrubby open forest primarily in the Kybeyan – Gourock subregion of the South Eastern Highlands bioregion

m31: Ribbon Gum – Snow Gum – *Cassinia longifolia* tall shrub-grass open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands bioregion

m51: Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll open forest on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan – Gourock subregions of the South Eastern Highlands bioregion

p8: Silvertop Ash – Narrow-leaved Peppermint shrubby tall dry open forest primarily on sedimentary ridges of the eastern South Eastern Highlands bioregion

p10: Black She-oak – Silvertop Ash tall shrubby dry sclerophyll open forest primarily in the Bungonia subregion of the South Eastern Highlands bioregion

p9: Brittle Gum – Scribbly Gum shrubby tall dry open forest on infertile low ridges and hills primarily of the Bungonia subregion of the South Eastern Highlands bioregion

p14: Red Stringybark – Scribbly Gum – *Rytidosperma pallidum* tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion

p23: Red Stringybark – Broad-leaved Peppermint tall dry sclerophyll grassy open forest on loamy rises primarily in the Bungonia subregion of the South Eastern Highlands bioregion

u18: Mealy Bundy – Broad-leaved Peppermint shrubby mid-high open forest on granite substrates primarily in the South Eastern Highlands

u21: Broad-leaved Peppermint – Candlebark tall dry sclerophyll open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps bioregions

u29: Apple Box – Broad-leaved Peppermint tall shrub-grass open forest primarily on granitoids of the South Eastern Highlands bioregion

u105: Broad-leaved Peppermint – Brittle Gum – Red Stringybark tall shrub-grass dry sclerophyll open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes bioregions

u148: Red Stringybark – Red Box grass-forb tall open forest of the upper South Western Slopes and western South Eastern Highlands bioregions

u150: Broad-leaved Peppermint – Mountain Gum shrubby tall open forest of the South Eastern Highlands and Australian Alps bioregions

u152: Robertson's Peppermint – Red Stringybark very tall grass-forb sheltered open forest of the southwest South Eastern Highlands and upper South Western Slopes bioregions

u165: Robertson's Peppermint very tall shrubby open forest primarily of the Bondo subregion of the South Eastern Highlands bioregion

u191: Black Cypress Pine – Brittle Gum tall dry open forest on hills primarily in the Cooma region

Class: Upper Riverina Dry Sclerophyll Forests

u43: Mealy Bundy – *Acacia implexa* – *Allocasuarina verticillata* – *Ricinocarpos bowmanii* tall grassy open woodland on serpentinite in the Coolac-Goobarragandra area primarily of the upper South Western Slopes bioregion

u66: Mealy Bundy – Red Stringybark grass-forb mid-high open forest of the South Eastern Highlands and Upper Slopes Subregion of the South Western Slopes bioregion

HEATHLANDS**Class: Southern Montane Heaths**

e53: *Allocasuarina nana* shrubland on exposed skeletal ridges of primarily in the eastern South Eastern Highlands bioregion

FORESTED WETLANDS**Class: Eastern Riverine Forests**

p32d: River She-oak riparian forest on sand/gravel alluvial soils along major watercourses of the South Eastern Highlands and upper South Western Slopes bioregions

p56: *Leptospermum grandifolium* – *Hakea microcarpa* – *Lomatia myricoides* riparian very tall shrubland of the eastern South Eastern Highlands bioregion

u181: *Callistemon sieberi* – *Kunzea ericoides* rocky riparian tall shrubland in the South Eastern Highlands and upper South Western Slopes bioregions

FRESHWATER WETLANDS

Class: Inland Riverine Forests

u173: River Red Gum ± Apple Box very tall grass-forb riparian woodland on alluvial flats in the South Eastern Highlands and upper South Western Slopes bioregions

Class: Montane Bogs and Fens

a9: *Carex gaudichaudiana* – *Ranunculus amphitrichus* – *Phragmites australis* aquatic herbfield of waterways in the Australian Alps and South Eastern Highlands bioregions

e59: *Hakea microcarpa* – *Baeckea utilis* – *Leptospermum myrtifolium* subalpine wet heathland on escarpment and eastern tableland ranges of the South Eastern Highlands bioregion

u193: *Hakea microcarpa* – *Epacris breviflora* – *Epacris paludosa* subalpine wet heathland of the Australian Alps and western South Eastern Highlands bioregions

Class: Montane Lakes

L12: Freshwater sedge-herb marsh of shallow, commonly inundated wetlands of the eastern South Eastern Highlands bioregion

L3: Freshwater sedge-herb marsh of shallow ephemeral lakes of the eastern South Eastern Highlands bioregion

L4: Freshwater sedge-herb marsh of deep semi-permanent and/or slightly saline wetlands of the eastern South Eastern Highlands bioregion

GRASSY WOODLANDS

Class: Subalpine Woodlands

a34: Weeping Snow Gum shrub-grass open woodland of the Australian Alps bioregion

u22: Mountain Gum – Snow Gum ± Robertson's Peppermint grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions

u23: Snow Gum – Drumstick Heath – *Leptospermum myrtifolium* tall woodland to open forest of drainage depressions primarily of the South Eastern Highlands bioregion

u27: Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion

u28: Snow Gum – Mountain Gum – *Daviesia mimosoides* tall dry grass-shrub subalpine open forest of the Australian Alps and South Eastern Highlands bioregions

u118: Black Sallee grass-herb woodland in drainage depressions and moist valley flats in the South Eastern Highlands and Australian Alps bioregions

u158: Alpine Sallee shrub-grass subalpine mid-high woodland of the Australian Alps bioregion

u207: Jounama Snow Gum – Snow Gum shrubby mid-high woodland on granitoids primarily of the Namadgi region

Class: Southern Tableland Grassy Woodlands

p24: Yellow Box – Blakely's Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands bioregion

u19: Blakely's Red Gum – Yellow Box ± White Box tall grassy woodland of the Upper South Western Slopes and western South Eastern Highlands bioregions

u20: Kurrajong – *Bursaria spinosa* – *Themeda australis* shrub-grass mid-high open woodland on limestone karsts in the Wee Jasper area

u178: Yellow Box ± Apple Box tall grassy woodland of the South Eastern Highlands bioregion

Class: Tableland Clay Grassy Woodlands

p220: Ribbon Gum – Snow Gum tableland flats tall grassy woodland primarily on granitoids in the Kybean – Gourock and Monaro subregions of the South Eastern Highlands bioregion

p520: Ribbon Gum very tall woodland on alluvial soils along drainage lines of the eastern South Eastern Highlands bioregion

u78: Snow Gum grassy mid-high woodland of the South Eastern Highlands bioregion

GRASSLANDS

Class: Temperate Montane Grasslands

r1: Sub-montane moist tussock grassland of the South Eastern Highlands bioregion

r2: *Poa labillardierei* – *Themeda australis* – *Juncus* sp. wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion

r3: *Rytidosperma* sp. – *Themeda australis* – *Juncus* sp. tussock grassland of occasionally wet sites of the South Eastern Highlands bioregion

r4: Lacustrine Grass-forbland of the South Eastern Highlands bioregion

r5: *Rytidosperma* sp. – *Austrostipa bigeniculata* – *Chrysocephalum apiculatum* tussock grassland of the South Eastern Highlands bioregion

r6: Dry tussock grassland of the Monaro in the South Eastern Highlands bioregion

r7: *Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* moist tussock grassland of the South Eastern Highlands bioregion

r8: *Themeda australis* – *Lomandra filiformis* – *Aristida ramosa* dry tussock grassland in the South Eastern Highlands bioregion

Plant community type descriptions

Additional to text descriptions, tabulated floristic information, photographs and figures, each plant community contains tabulated summary information as follows:

Number of samples: Number of field samples assigned to a particular community and used to characterise species composition and habitat.

Richness [mean (\pm SD)]: Average richness of native species per plot sample within a particular plant community (\pm 1 standard deviation).

Slope (degrees): Approximate ground surface slope of samples assigned to a particular plant community, as [(minimum) 25th percentile – 75th percentile (maximum)] (from GIS; sample intersect with slope surface generated from 25m digital elevation model).

Altitude (m asl): Approximate elevation of samples assigned to a particular plant community, as [(minimum) 25th percentile – 75th percentile (maximum)] (from GIS; sample intersect with elevation surface generated from 25m DEM).

Ave. Annual Rainfall (mm): Modelled average annual rainfall of plots assigned to a particular plant community, as [(minimum) 25th percentile – 75th percentile (maximum)] (from GIS; sample intersect with climate surface generated using BioClim software).

Temp. Annual Range ($^{\circ}$ C): Modelled annual temperature range (mean maximum of warmest month minus mean minimum of coldest month) of samples assigned to a particular plant community, as [(minimum) 25th percentile – 75th percentile (maximum)] (from GIS; sample intersect with climate surface generated using BioClim software).

Formation: Alpine Complex

Class: Alpine Herbfields

a6: *Ranunculus millanii* – *Lobelia surrepens* – *Carex gaudichaudiana* herbfield of shallow depressions of the Australian Alps bioregion

Scientific Name: *Ranunculus millanii* – *Lobelia surrepens* – *Carex gaudichaudiana* – *Dichondra repens* – *Hydrocotyle sibthorpioides* – *Gonocarpus micranthus*

Number of samples:	5
Richness [mean (\pm SD)]:	11 (4)
Slope (degrees):	(1) 2–3 (6)
Altitude (m asl):	(1156) 1268–1302 (1527)
Ave. Annual Rainfall (mm):	(1037) 1123–1564 (1590)
Temp. Annual Range ($^{\circ}$ C):	(22.2) 23.3–24.2 (24.3)

Vegetation Description: Community a6 is a wet low sedgeland/herbfield with characteristic species including *Lobelia surrepens*, *Ranunculus millanii*, *Gonocarpus micranthus*, *Isolepis montivaga*, *Myriophyllum pedunculatum*, *Stachousia pulvinaris* and *Lachnagrostis meionectes*.



Plate a6: A depression in *Poa fawcettiae* grassland, the habitat of community a6; this example near Spencers Creek, Kosciuszko NP. The flora of this community is distinct from that of surrounding communities only a few cm away. The depressions are often water-filled in spring and late autumn.

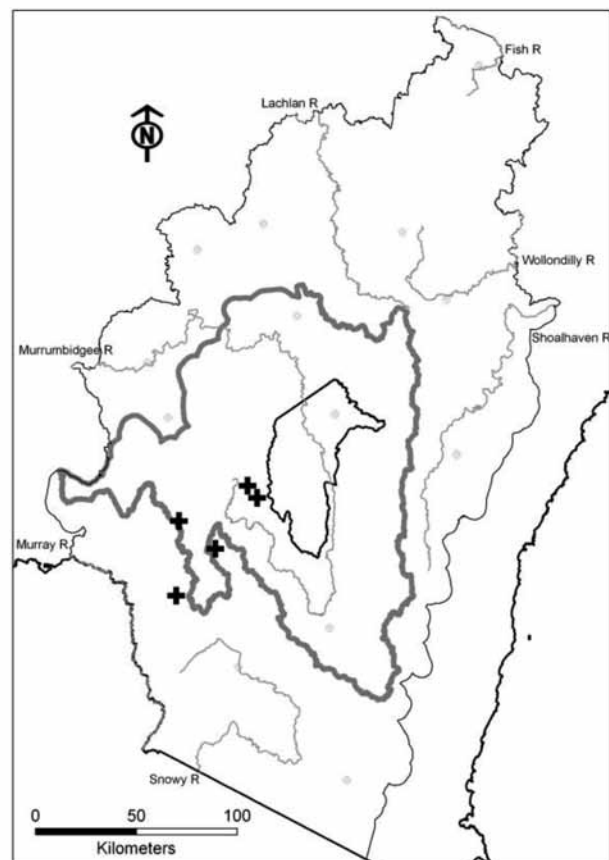


Fig. a6: Distribution of field samples assigned to plant community a6.

Carex gaudichaudiana is usually present, particularly in deeper sections of the depressions where water tends to persist for longer periods.

This community occurs on the Bimberi Range (ACT), northern Kosciuszko NP and surrounds (e.g. Kiandra, Seventeen Flat, Broadway Plain, McPhersons Plain and Cooleman Plain) and a number of sites of suitable topography in Victoria where it is locally common. It is confined to, and highly characteristic of, seasonally inundated depressions of alpine and high subalpine areas. There appears to be no convincing explanation for the genesis of these formations. The depressions may be more or less linear and oriented across slopes or they may be nearly circular on almost flat ground. They are underlain by water-retentive soils, often derived from igneous parent material, and filled with water following snow-melt. By early summer they are usually empty of surface water, but soils remain moist through the season (sometimes filling again during heavy rains).

Individual examples of Community a6 are often only a few square metres in area, but there will generally be many within a grassland stand. The main grassland community in which this is expected is Community a30 [*Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion]. Less commonly, it is found amongst grassy heathland, such as Community a42 [*Epacris celata* – *Poa clivicola* – *Dillwynia palustris* grassy heathland of the Australian Alps bioregion].

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Carex chlorantha</i>	3	40	1	<1	P
<i>Carex gaudichaudiana</i>	3	100	2	4	P
<i>Dichondra repens</i>	1	80	2	21	P
<i>Gonocarpus micranthus</i>	3	60	1	2	P
<i>Hydrocotyle sibthorpioides</i>	2	80	2	4	P
<i>Hypericum japonicum</i>	2	40	1	4	P
<i>Isolepis fluitans</i>	1	20	2	<1	P
<i>Isolepis montivaga</i>	1	20	1	<1	P
<i>Isolepis</i> spp.	1	40	1	<1	P
<i>Juncus brevibracteus</i>	1	40	1	<1	P
<i>Lobelia surrepens</i>	3	80	2	<1	P
<i>Luzula alpestris</i>	1	20	1	<1	P
<i>Myriophyllum pedunculatum</i>	1	20	1	<1	P
<i>Plantago alpestris</i>	1	20	1	<1	P
<i>Plantago antarctica</i>	1	20	1	<1	P
<i>Pultenaea fasciculata</i>	1	20	1	<1	P
<i>Ranunculus millanii</i>	2	80	1	<1	P
<i>Spiranthes australis</i>	1	20	1	<1	P
<i>Asperula gunnii</i>	1	40	1	5	C
<i>Viola betonicifolia</i>	1	60	1	27	C

Threatened communities: Nil.

Equivalent vegetation types: Unit 8A [*Pratia depression*] and Unit 8B [*Fen (Bog pool)*] (McDougall 1982); *Damp alpine heathland* Sub-community 10.1 (Walsh et al. 1984); Vegetation Type 9 (Helman & Gilmour 1985); Community 6 [*Lobelia surrepens* – *Ranunculus millanii* herbfield] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.20), *Poa pratensis* (0.20), *Rorippa palustris* (0.20), *Rumex conglomeratus* (0.20), *Taraxacum officinale* (0.20), *Trifolium repens* (0.20).

Threats: Trampling by livestock or feral horses may damage plants or soils but the threat is currently low.

Reservation status: Mostly in Kosciuszko NP as well as Namadgi NP, but some examples are on freehold or leasehold land west of Kosciuszko NP.

Extent of clearing: Nil.

References: Helman, C.E. & Gilmour, P.M. (1985) Treeless vegetation above 1,000 metres altitude in the A.C.T. Unpublished report. Conservation Council of the Southeast Region and Canberra: Canberra; McDougall, K.L. (1982) The alpine vegetation of the Bogong high plains. Environmental studies publication no. 357. Ministry for Conservation: Melbourne; McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57; Walsh, N.G., Barley, R.H. & Gullan, P.K. (1984) The alpine vegetation of Victoria (excluding the Bogong high plains), volume 1. Environmental studies publication no. 376. Department of Conservation, Forests and Lands: Melbourne.

a14: *Poa costiniana* – *Carex gaudichaudiana* subalpine valley grassland of the Australian Alps bioregion

Scientific Name: *Poa costiniana* – *Carex gaudichaudiana* – *Stellaria angustifolia* – *Asperula gunnii* – *Luzula modesta*

Number of samples:	23
Richness [mean (±SD)]:	18 (6)
Slope (degrees):	(0) 1–6 (14)
Altitude (m asl):	(1008) 1237–1434 (1618)
Ave. Annual Rainfall (mm):	(807) 1082–1468 (1912)
Temp. Annual Range (°C):	(21.7) 22.8–24.5 (26.1)

Vegetation Description: Community a14 is a grassland or occasionally open heathland confined to broad valley floors and seepage areas on gentle slopes. Dominant species vary between localities, but common components include herbaceous species such as *Poa costiniana*, which is usually dominant, *Hookerchloa hookeriana*, *Baloskion australe*, *Carex gaudichaudiana*, *Empodisma minus* and *Stylidium montanum* as well as shrubs including *Epacris breviflora*, *Epacris gunnii* and *Hakea microcarpa*. In the northern part of its range, including the ACT, *Poa labillardierei* is often dominant. Soils are typically sodden humified peats.

Community a14 is common from Bimberi, Brindabella and Scabby Ranges (ACT), through lower altitude plains within Kosciuszko NP (Kiandra and Tantangara areas, Mt. Selwyn, Tooma/Tumut Divide, Cooleman Plain, Happy Jacks Plain and Currango Plain). It also occurs in the more easterly ranges of Victoria (e.g. Mt. Wombargo-Cobberas area, Nunniong Plateau, Davies Plain and Dinner Plain). It commonly grades into Community a2 [*Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)] in areas with impeded drainage and Community a30 [*Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion] on drier sites.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Asperula gunnii</i>	1	74	1	4	P
<i>Baloskion australe</i>	1	30	1	2	P
<i>Brachyscome decipiens</i>	1	26	1	2	P
<i>Brachyscome obovata</i>	1	30	1	<1	P
<i>Cardamine astoniae</i>	1	39	1	<1	P
<i>Carex gaudichaudiana</i>	2	91	2	3	P
<i>Carex jackiana</i>	1	26	1	<1	P
<i>Cassinia monticola</i>	1	22	1	1	P
<i>Craspedia crocata</i>	1	22	2	<1	P
<i>Empodisma minus</i>	2	52	2	3	P
<i>Epacris gunnii</i>	1	35	1	2	P
<i>Epilobium billardierianum</i>	1	39	1	2	P
<i>Epilobium gunnianum</i>	1	43	1	1	P
<i>Hookerchloa hookeriana</i>	2	26	1	<1	P
<i>Hydrocotyle algida</i>	1	22	1	<1	P

<i>Hypericum japonicum</i>	1	39	1	3	P
<i>Luzula modesta</i>	1	61	1	2	P
<i>Montia australasica</i>	1	35	1	1	P
<i>Oreomyrrhis ciliata</i>	1	43	1	2	P
<i>Poa costiniana</i>	4	100	2	4	P
<i>Ranunculus graniticola</i>	1	48	1	4	P
<i>Ranunculus millanii</i>	1	30	2	<1	P
<i>Ranunculus pimpinellifolius</i>	1	35	1	1	P
<i>Senecio gunnii</i>	1	39	1	9	P
<i>Stellaria angustifolia</i>	1	61	1	1	P

Threatened communities: Nil

Equivalent vegetation types: part of *Poa caespitosa* – *Danthonia nudiflora* alliance (Costin 1954); *Damp alpine heathland*, Sub-community 10.3 (Walsh *et al.* 1984); Community 7 (Benson 1994); Group 10 (Helman *et al.* 1988); Community 14 [*Subalpine valley grassland*] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.31), *Taraxacum officinale* (0.58), *Trifolium repens* (0.35).

Threats: Some sites in NSW (Kiandra area) and Victoria (near Mt. Wombargo) are subject to excavation by feral pigs, causing these sites to dry. Its greater fertility than surrounding vegetation and permanent wetness makes the community especially vulnerable to weed invasion. *Holcus lanatus*, *Anthoxanthum odoratum* and *Leucanthemum vulgare* have formed extensive colonies at some sites and pose a great threat to this vegetation.

Reservation status: Well reserved, with almost all examples in NSW occurring within Kosciuszko NP.

Extent of clearing: Nil, but this community was probably degraded through decades of grazing in the 19th and 20th centuries.

References: Benson, J.S. (1994) The native grasslands of the Monaro region: southern tablelands of New South Wales. *Cunninghamia* 3: 609–650; Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); Helman, C.E., Gilmour, P.M., Osborne, W.S. & Green, K. (1988) An ecological survey of the upper Cotter catchment wilderness area, Namadgi National Park, ACT. Unpublished report. Conservation Council of the South-east Region and Canberra, Canberra; McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57; Walsh, N.G., Barley, R.H. & Gullan, P.K. (1984) The alpine vegetation of Victoria (excluding the Bogong high plains), volume 1. Environmental studies publication no. 376. Department of Conservation, Forests and Lands: Melbourne.

a22: *Poa fawcettiae* – *Celmisia costiniana* – *Craspedia maxgrayi* grassland of the Australian Alps bioregion

Scientific Name: *Poa fawcettiae* – *Celmisia costiniana* – *Craspedia maxgrayi* – *Euphrasia collina* subsp. *diversicolor* – *Pentachondra pumila*

Number of samples:	25
Richness [mean (±SD)]:	20 (4)
Slope (degrees):	(1) 4–18 (22)
Altitude (m asl):	(1727) 1937–2083 (2182)
Ave. Annual Rainfall (mm):	(2070) 2290–2560 (2667)
Temp. Annual Range (°C):	(19.6) 20–20.6 (21.6)

Vegetation Description: Community a22 is a grassland generally dominated by *Poa fawcettiae*, although *Poa hiemata* and *Pentachondra pumila* may be locally dominant. The main forbs include *Celmisia costiniana* and *Craspedia maxgrayi*. Species diversity is usually high (compared with other communities at similar elevation). Tall shrubs



Plate a14: Community a14 is typically dominated by the tussocks of *Poa costiniana* and is common on drainage flats in the montane and subalpine zones of the Australian Alps. This example is at Rocky Plains on the Snowy Mountain Highway, east of Kiandra.

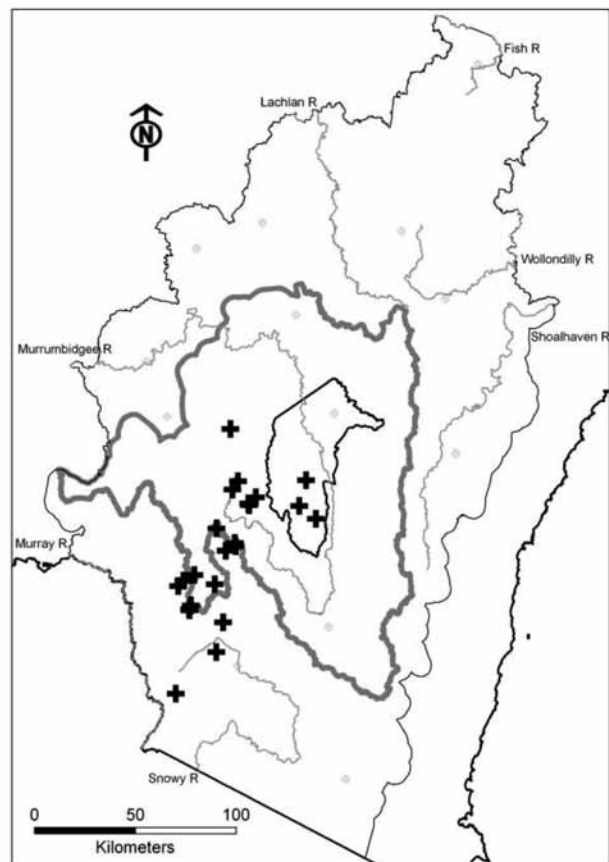


Fig. a14: Distribution of field samples assigned to this community.

are rare. A species-poor variant of the community (Community 18 of McDougall & Walsh 2007) is found on Mt. Jagungal and Mt. Twynam and is incorporated into the current plant community concept. On Mt. Twynam at least, it may be a result of assisted regeneration following severe erosion caused by cattle grazing. That area was the subject of major soil conservation works in the 1960s after grazing was removed.

Community a22 occurs on sites of low relief with deep soils (e.g. saddles and stream heads) between the Main Range and Mt. Jagungal in Kosciuszko NP. It is not known whether this community occurs in the upper Murrumbidgee catchment, being present on the southern and eastern fall of Mt. Jagungal, which marks the boundary of the catchment. Throughout its range, it grades into Community a46 [*Prostanthera cuneata* – *Orites lancifolius* – *Nematolepis ovatifolia* heathland of the Australian Alps bioregion]. The ecotone between these communities is large and it will often be difficult to map a boundary between them where the dominants of the heathland are scattered through the grassland.



Characteristic Species:

Species	C/A	Freq	C/AO	Freq	O	Fid
<i>Aciphylla glacialis</i>	1	32	1	<1		P
<i>Acrothamnus montanus</i>	1	48	1	<1		P
<i>Argyrotegium fordianum</i>	1	32	1	<1		P
<i>Australopyrum velutinum</i>	1	20	1	<1		P
<i>Brachyscome scapigera</i>	1	20	1	2		P
<i>Carex breviculmis</i>	1	92	1	12		P
<i>Carex hebes</i>	1	36	1	1		P
<i>Celmisia costiniana</i>	2	76	1	<1		P
<i>Celmisia pugioniformis</i>	1	24	1	2		P
<i>Craspedia aurantia</i>	1	44	1	1		P
<i>Craspedia costiniana</i>	1	28	1	<1		P
<i>Craspedia maxgrayi</i>	1	72	1	<1		P
<i>Deyeuxia crassiuscula</i>	1	20	1	<1		P
<i>Empodisma minus</i>	1	20	2	3		P
<i>Euphrasia collina</i> subsp. <i>diversicolor</i>	1	52	1	<1		P
<i>Gentianella muelleriana</i> subsp. <i>alpestris</i>	1	40	1	<1		P
<i>Grevillea australis</i>	1	20	2	2		P
<i>Luzula alpestris</i>	1	28	1	<1		P
<i>Luzula modesta</i>	1	20	1	2		P
<i>Lycopodium fastigiatum</i>	1	28	1	<1		P
<i>Microseris lanceolata</i>	1	76	1	6		P
<i>Oreomyrrhis eriopoda</i>	1	76	1	13		P
<i>Pentachondra pumila</i>	1	44	1	<1		P
<i>Pimelea alpina</i>	1	60	1	1		P
<i>Plantago euryphylla</i>	1	24	1	<1		P
<i>Poa costiniana</i>	3	48	2	4		P
<i>Poa fawcettiae</i>	3	60	2	2		P
<i>Prasophyllum</i> spp.	1	36	1	<1		P
<i>Ranunculus graniticola</i>	2	20	1	4		P
<i>Rytidosperma nudiflorum</i>	1	88	1	2		P
<i>Saxipoa saxicola</i>	1	40	1	<1		P
<i>Scleranthus singuliflorus</i>	1	20	1	<1		P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	52	1	3		P
<i>Trisetum spicatum</i>	1	72	1	2		P

Threatened communities: Nil.

Equivalent vegetation types: part of *Celmisia longifolia* – *Poa caespitosa* alliance (Costin 1954); part of the *Tall alpine herbfield* of Costin et al. (2000); combination of Communities 18 [*Poa fawcettiae* – *Uncinia sulcata* grassland] and 22 [*Poa fawcettiae* – *Euphrasia collina* grassland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.46).

Threats: Chronological aerial photograph interpretation indicates that the area of this community has declined in the past 60 years because of encroachment by shrubs. It is uncertain if this is the result of climate

Plate a22: Community a22 is rare in the study area, found only near the summit of Mt Jagungal. This example is on the slopes of the Main Range of Kosciuszko NP.

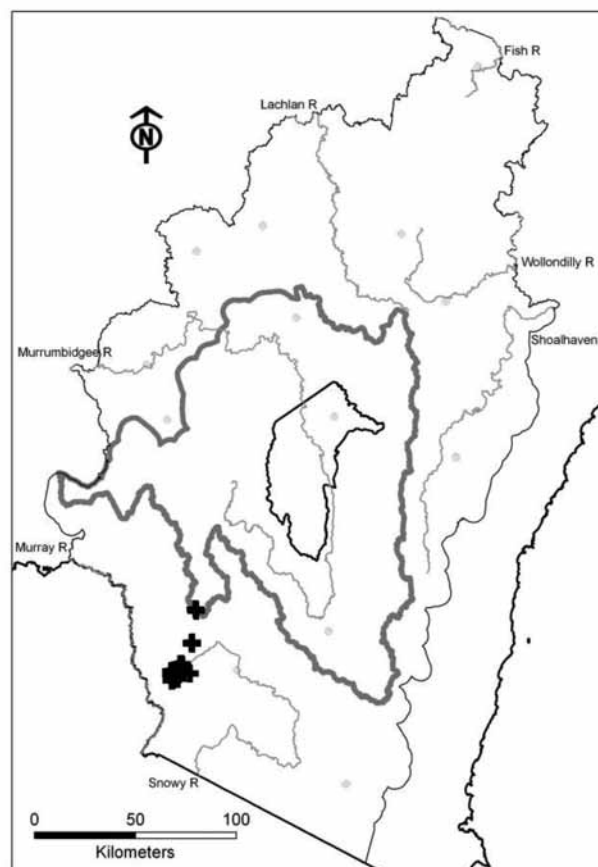


Fig. a22: Distribution of field samples assigned to this community.22

change or disturbance by sheep and cattle, as both factors may favour shrub establishment.

Reservation status: Entirely within Kosciuszko NP.

Extent of clearing: Nil, though formerly much of the community had been severely degraded by sheep and cattle grazing.

References: Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); Costin, A.B., Gray, M., Totterdell, C.J. & Wimbush D.J. (2000) Kosciuszko alpine flora. (CSIRO Publishing: Collingwood); McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

a30: *Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion

Scientific Name: *Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* – *Geranium antrorsum*

Number of samples:	54
Richness [mean (±SD)]:	28 (6)
Slope (degrees):	(0) 2–8 (22)
Altitude (m asl):	(1194) 1285–1397 (1619)
Ave. Annual Rainfall (mm):	(969) 1186–1459 (1814)
Temp. Annual Range (°C):	(21.7) 23.2–24.1 (25)

Vegetation Description: Community a30 is a grassland characterised by a dense cover of one or often several species of *Poa* (mainly *Poa clivicola*, *Poa costiniana*, *Poa hiemata* or *Poa hookeri* but occasionally *Poa petrophila* or *Poa phillipsiana*) with numerous intertussock spaces containing a large range of herbaceous species. Tall shrubs such as *Hakea microcarpa* and *Cassinia monticola* may be present in this community and at times are abundant enough for the vegetation to be structurally an open heathland. Despite the greater shrub cover, such examples are floristically inseparable from surrounding grasslands. There is photographic evidence that these shrubs are recent invaders of the grassland community. Their invasion has probably been facilitated by past grazing disturbance, although climate change will also favour expansion of shrubs into frost hollows.

The component of this community dominated by *Poa hookeri* was regarded as a distinct community by McDougall & Walsh (2007) and may well be so. In the places where it occurs (Kosciuszko NP north from the Happy Jacks area), it forms a mosaic with grassland dominated by other species, making it hard to collect homogeneous samples and increasing the likelihood of combination in the classification. In any case, the grasslands would be inseparable as a mapping unit. The *Poa hookeri*-dominated variant is characterised by dwarf tussocks of *Poa hookeri* and the closed cover of mat-forming herbs, shrubs and low shrubs (e.g. *Calotis pubescens*, *Coprosma nivalis*, *Dillwynia prostrata*, *Pimelea biflora*, *Pultenaea fasciculata*, *Pultenaea polifolia*, *Rutidos leioplepis*).

Community a30 is the most common grassland of the treeless plains in Kosciuszko NP, occurring from the upper Thredbo Valley in the south to Emu Plain in the west, Cooleman Plain in the north and Snowy Plain in the east. It is the dominant community of large plains such as Kiandra, Happy Jacks and Long Plains and also occurs in the ACT at Cheyenne Flat and Bimberly (and probably elsewhere at high altitude). Its distribution is controlled by temperature and soil depth: low temperatures associated with cold air drainage in the growing season do not favour tall shrub and tree establishment. It is best expressed where soils are deep and on shallow soils it is replaced by heathlands and woodlands.

The lower edge of this community commonly adjoins Community a14 [*Poa costiniana* – *Carex gaudichaudiana* subalpine valley grassland of the Australian Alps bioregion] and its upper edge is usually Community u158 [*Alpine Sallee shrub-grass subalpine mid-high woodland of the*

Australian Alps bioregion]. Patches of Community a33 [*Bossiaea foliosa* – *Cassinia monticola* – *Kunzea muelleri* – *Hovea montana* heathland of the Australian Alps bioregion] and Community a34 [*Weeping Snow Gum* – *Small-fruited Hakea* – *Blue Snow-grass grassy open woodland of the Australian Alps bioregion*] may be found in a mosaic within the grassland.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acaena echinata</i>	1	33	1	9	P
<i>Aciphylla simplicifolia</i>	1	33	1	2	P
<i>Acrothamnus hookeri</i>	1	65	1	7	P
<i>Ajuga australis</i>	1	26	1	8	P
<i>Asperula gunnii</i>	1	63	1	4	P
<i>Asterolasia trymalioides</i>	1	15	2	<1	P
<i>Australopyrum velutinum</i>	1	28	1	<1	P
<i>Brachyscome aculeata</i>	1	33	1	2	P
<i>Brachyscome decipiens</i>	1	37	1	1	P
<i>Brachyscome scapigera</i>	1	24	1	2	P
<i>Cardamine lilacina</i>	1	22	1	1	P
<i>Carex breviculmis</i>	1	94	1	12	P
<i>Carex hebes</i>	1	28	1	1	P
<i>Celmisia pugioniformis</i>	1	30	1	2	P
<i>Craspedia coolaminica</i>	1	78	1	<1	P
<i>Craspedia jamesii</i>	1	54	1	3	P
<i>Diuris monticola</i>	1	26	1	<1	P
<i>Epilobium billardierianum</i>	1	43	1	1	P
<i>Erigeron bellidioides</i>	1	28	1	<1	P
<i>Euphrasia collina</i> subsp. <i>paludosa</i>	1	39	1	2	P
<i>Festuca asperula</i>	1	15	1	1	P
<i>Geranium antrorsum</i>	1	91	1	2	P
<i>Grevillea australis</i>	2	15	1	2	P
<i>Hakea microcarpa</i>	2	19	1	3	P
<i>Hovea montana</i>	1	17	1	1	P
<i>Hovea</i> aff. <i>heterophylla</i> (Kiandra)	1	20	1	<1	P
<i>Leptorhynchos elongatus</i>	1	17	1	<1	P
<i>Leptorhynchos squamatus</i>	1	72	1	2	P
<i>Linum marginale</i>	1	13	1	1	P
<i>Luzula flaccida</i>	1	59	1	12	P
<i>Melicytus</i> sp. 'Snowfields'	1	19	1	3	P
<i>Microseris lanceolata</i>	1	56	1	6	P
<i>Oreomyrrhis argentea</i>	1	56	1	<1	P
<i>Pimelea biflora</i>	1	24	1	<1	P
<i>Pimelea linifolia</i> subsp. <i>caesia</i>	1	57	1	8	P
<i>Plantago antarctica</i>	1	19	1	<1	P
<i>Plantago euryphylla</i>	1	30	1	<1	P
<i>Poa clivicola</i>	3	50	2	1	P
<i>Poa hiemata</i>	3	24	2	1	P
<i>Poa hookeri</i>	3	43	3	<1	P
<i>Poa costiniana</i>	3	22	2	4	P
<i>Poa fawcettiae</i>	1	17	3	2	P
<i>Poa petrophila</i>	2	17	2	<1	P
<i>Poa phillipsiana</i>	2	41	3	2	P
<i>Podolepis jaceoides</i>	1	46	1	<1	P
<i>Poranthera oreophila</i>	1	54	1	27	P
<i>Prasophyllum</i> spp.	1	15	1	<1	P
<i>Pultenaea fasciculata</i>	2	19	1	<1	P
<i>Pultenaea polifolia</i>	1	20	1	<1	P
<i>Ranunculus graniticola</i>	1	89	1	3	P
<i>Rhodanthe anthemoides</i>	1	37	1	<1	P
<i>Rhytidosporum alpinum</i>	1	19	1	<1	P
<i>Rytidosperma</i> spp.	1	33	1	7	P
<i>Rutidos leioplepis</i>	2	15	2	<1	P
<i>Scleranthus biflorus</i>	1	81	1	9	P
<i>Scleranthus fasciculatus</i>	1	26	1	<1	P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	50	1	2	P
<i>Swainsona monticola</i>	1	13	1	<1	P
<i>Trisetum spicatum</i>	1	46	1	2	P
<i>Xerochrysum subundulatum</i>	1	26	1	<1	P

Threatened communities: Nil.

Equivalent vegetation types: Vegetation Type 2 (Helman & Gilmour 1985); Group 16 (Helman et al. 1988); Community 6 (Benson 1994); combination of Communities 30 [*Poa hiemata* – *Poa clivicola* grassland] and 31 [*Poa hookeri* grassland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.59), *Hypochaeris radicata* (0.59).

Threats: Despite its great spatial extent in conservation reserves, this community is one of the most threatened communities in the Alps and upper Murrumbidgee catchment. Patches of up to 100 m² may be overturned by pigs causing the exposure of bare soil, a large reduction in the cover of *Poa* species, and an increase in disturbance tolerant species such as *Geranium antrorsum*, *Drabastrum alpestre* and *Stellaria multiflora* (McDougall & Walsh 2002). Horses are commonly seen in this grassland and presumably selectively graze some of its species. Grassland forbs were found to be selectively grazed by cattle on the Bogong High Plains in Victoria (Van Rees & Holmes 1986), so it is possible that horses are having a significant effect on species abundance and turnover. Investigation of horse diet is urgently required, given the high incidence of rare and threatened plant species in this community (McDougall & Walsh 2007). Invasion by *Leucanthemum vulgare* is also a significant threat, with this weed spreading rapidly in recent years near Tantangara Dam. Based on its invasion ecology and impact elsewhere (Clements et al. 2004), the containment of this weed will be essential for the future survival of this community.

Reservation status: Mostly within Kosciuszko NP; some examples on freehold land at Snowy Plain (in the Southern Rivers CMA).

Extent of clearing: Nil, but probably highly degraded in places by domestic grazing and, at Kiandra, mining.

References: Benson, J.S. (1994) The native grasslands of the Monaro region: southern tablelands of New South Wales. *Cunninghamia* 3: 609–650; Helman, C.E. & Gilmour, P.M. (1985) Treeless vegetation above 1,000 metres altitude in the A.C.T. Unpublished report. Conservation Council of the Southeast Region and Canberra: Canberra; Helman, C.E., Gilmour, P.M., Osborne, W.S. & Green, K. (1988) An ecological survey of the upper Cotter catchment wilderness area, Namadgi National Park, ACT. Unpublished report. Conservation Council of the South-east Region and Canberra, Canberra; McDougall, K.L. & Walsh, N.G. (2002) The flora of Nungar plain, a treeless sub-alpine frost hollow in Kosciuszko National Park. *Cunninghamia* 7: 601–610; McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57; Van Rees, H. & Holmes, J.H.G. (1986) The botanical composition of the diet of free-ranging cattle on an alpine range in Australia. *Journal of Range Management* 39: 392–395.

a38: *Themeda australis* – *Galium roddii* – *Leucochrysum alpinum* grassland of steep limestone slopes in the Australian Alps bioregion

Scientific Name: *Themeda australis* – *Galium roddii* – *Leucochrysum alpinum* – *Cassinia ochracea* – *Xerochrysum viscosum*

Number of samples:	6
Richness [mean (±SD)]:	15 (4)
Slope (degrees):	(2) 14–27 (39)
Altitude (m asl):	(1185) 1207–1220 (1240)
Ave. Annual Rainfall (mm):	(1080) 1081–1082 (1084)
Temp. Annual Range (°C):	(24.7) 24.7–24.8 (24.8)

Vegetation Description: Community a38 is a grassland mainly dominated by *Themeda australis* and *Poa fawcettiae*, although plant cover is sometimes sparse amongst limestone outcrops. While shrub cover is generally low, there are occasional emergent shrubs of *Cassinia ochracea*, *Grevillea lanigera* and *Hakea microcarpa*. Several taxa



Plate a30: The most common grassland of montane to subalpine parts of the Kosciuszko and Namadgi NPs is Community a30, which is dominated by one of several *Poa* species. This example in Nungar Plain (Kosciuszko NP) is dominated by *Poa hookeri*.

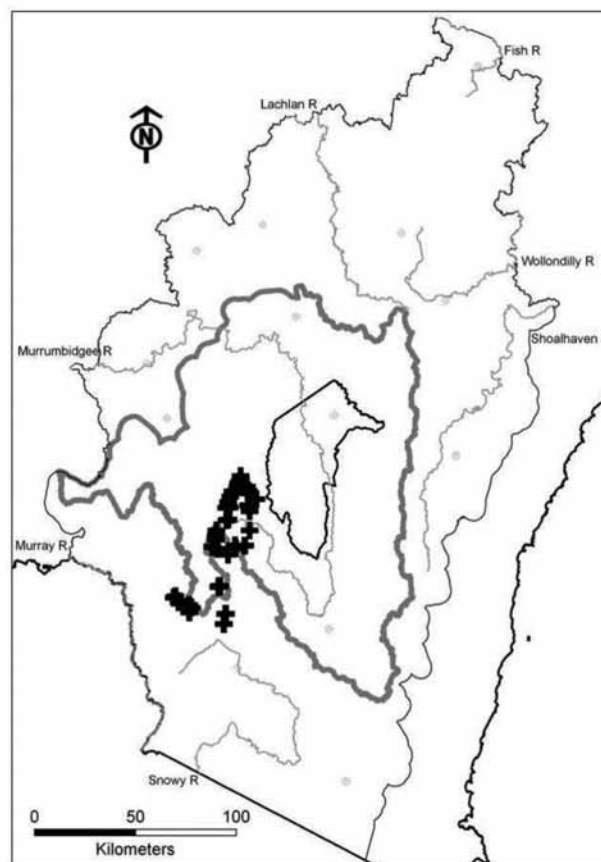


Fig. a30: Distribution of field samples assigned to this community.

otherwise uncommon in treeless vegetation in the Australian Alps grow in this community which are restricted to limestone landscapes (e.g. *Bulbine glauca*, *Clematis leptophylla*, *Convolvulus angustissimus*, *Galium roddii*, *Xerochrysum viscosum*).

This community is common on steep slopes in the Blue Waterholes area of Kosciuszko NP (Cave Creek), where it occurs on loose limestone scree and around rocky outcrops. Slopes in similar habitat at Yarrangobilly Caves about 25 km south of Blue Waterholes support small pockets of this community within a forested landscape.

Characteristic Species:

Species	C/A	Freq	C/AO	Freq	O	Fid
<i>Brachyscome rigidula</i>	1	33	1	2		P
<i>Carex breviculmis</i>	1	100	1	13		P
<i>Cassinia ochracea</i>	1	67	1	<1		P
<i>Clematis leptophylla</i>	1	33	1	2		P
<i>Convolvulus angustissimus</i>	1	67	1	3		P
<i>Craspedia coolaminica</i>	1	50	1	2		P
<i>Galium roddii</i>	1	50	1	<1		P
<i>Grevillea lanigera</i>	1	33	1	3		P
<i>Hakea microcarpa</i>	1	83	1	3		P
<i>Leucochrysum alpinum</i>	1	100	1	<1		P
<i>Linum marginale</i>	1	67	1	1		P
<i>Muehlenbeckia axillaris</i>	2	33	1	<1		P
<i>Picris angustifolia</i> subsp. <i>merxmulleri</i>	1	67	1	2		P
<i>Pimelea linifolia</i> subsp. <i>caesia</i>	1	83	1	8		P
<i>Poa fawcettiae</i>	3	100	3	2		P
<i>Rhodanthe anthemoides</i>	1	33	1	1		P
<i>Themeda australis</i>	3	100	2	21		P
<i>Vittadinia cuneata</i>	1	67	1	2		P
<i>Xerochrysum viscosum</i>	1	83	1	1		P

Threatened communities: Nil.

Equivalent vegetation types: Community 38 [*Themeda triandra* – *Leucochrysum albicans* grassland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Cerastium vulgare* (0.33), *Crepis capillaris* (0.50), *Echium vulgare* (0.33), *Hypochaeris radicata* (0.67), *Rosa rubiginosa* (0.67), *Sedum acre* (0.67), *Tragopogon dubius* (0.67), *Trifolium dubium* (0.83).

Threats: The Cave Creek area has a high diversity of weeds, some of which are locally abundant. *Sedum acre* occupies a niche on rocky sites also occupied by the very restricted *Galium roddii*, which appears to be threatened as a result. Many of the weeds present in Cave Creek are locally dominant in similar habitat at Yarrangobilly Caves (e.g. *Potentilla recta*, *Rosa rubiginosa*, *Tragopogon dubius*, *Verbascum thapsus*). Control of these and other weed species may be required in the future. Control will be difficult, however, because the steep slopes of Cave Creek are unstable and frequent pedestrian traffic could have a significant impact on plants growing there.

Reservation status: Entirely within Kosciuszko NP.

Extent of clearing: Nil.

Reference: McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.



Plate a38: Community a38 is a grassland with scattered shrubs confined to karst areas at Yarrangobilly and Blue Waterholes in Kosciuszko NP. This photo was taken near Blue Waterholes one year after the 2003 fires which burnt all of the community.

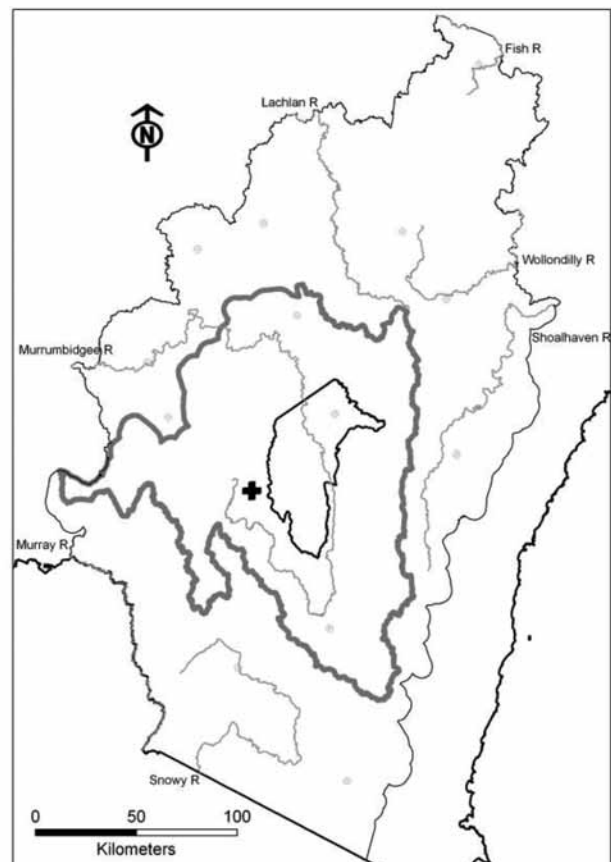


Fig. a38: Distribution of field samples assigned to this community.

Class: Alpine Heaths

a33: *Bossiaea foliosa* – *Cassinia monticola* – *Kunzea muelleri* – *Hovea montana* heathland of the Australian Alps bioregion

Scientific Name: *Bossiaea foliosa* – *Cassinia monticola* – *Epacris petrophila* – *Hovea montana* – *Kunzea muelleri* – *Pimelea biflora* / *Poa hiemata*

Number of samples:	36
Richness [mean (±SD)]:	26 (5)
Slope (degrees):	(0) 3–10 (21)
Altitude (m asl):	(1241) 1330–1582 (1790)
Ave. Annual Rainfall (mm):	(1144) 1506–1777 (2050)
Temp. Annual Range (°C):	(21.1) 21.8–23.3 (24.1)

Vegetation Description: Community a33 can occur as either a closed or open heathland dominated by shrubs 1 to 1.5 metres tall, such as *Bossiaea foliosa*, *Epacris petrophila*, *Hovea montana*, *Cassinia monticola*, *Grevillea australis*, *Kunzea muelleri* or *Podolobium alpestre*. Gaps between shrubs are commonly dominated by *Poa clivicola*, *Poa fawcettiae* or *Poa phillipsiana*, and occasionally *Austrostipa nivicola*, with many forbs characteristic of the adjoining grassland Community a30 [*Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion]. In the Murray catchment (e.g. upper Tooma River catchment), the heathland is commonly dominated by *Bossiaea foliosa* and despite the closed nature of this variant, the diversity of forbs and grasses is high. *Dichelachne crinita*, an uncommon species in the higher Alps, is a common component there.

Within the upper Murrumbidgee catchment, this community is abundant in Kosciuszko NP (e.g. Long Plain, Bullocks Hill, Currango Plain) and Namadgi NP (e.g. Mt. Bimberi, Mt. Murray, Mt. Gingera). It may be found in a mosaic with Community a30 [*Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion] but usually occupies the upper slopes of subalpine frost hollows.

Community a33 is a combination of three heathland Communities 33, 35 and 36 of McDougall & Walsh (2007). These communities may be separable floristically, each being influenced by the herbaceous composition of surrounding grassland communities. However, at their extremities the differences between them are minor and, for mapping purposes, they are likely to be indistinguishable.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Aciphylla simplicifolia</i>	1	72	1	2			P
<i>Acrothamnus hookeri</i>	1	33	1	8			P
<i>Asperula gunnii</i>	1	58	1	4			P
<i>Bossiaea foliosa</i>	2	31	2	4			P
<i>Brachyscome decipiens</i>	1	25	1	1			P
<i>Brachyscome scapigera</i>	1	25	1	2			P
<i>Brachyscome spathulata</i>	1	33	1	11			P
<i>Cardamine lilacina</i>	1	39	1	<1			P
<i>Carex breviculmis</i>	1	92	1	12			P
<i>Carex hebes</i>	1	22	1	1			P
<i>Cassinia monticola</i>	1	56	1	<1			P
<i>Celmisia pugioniformis</i>	1	42	1	2			P
<i>Craspedia coolaminica</i>	1	28	1	2			P
<i>Craspedia jamesii</i>	1	75	1	3			P
<i>Empodisma minus</i>	1	25	2	3			P
<i>Epacris gunnii</i>	1	33	1	2			P



Plate a33: Community a33 is a common shrubland found in and around Kosciuszko and Namadgi NPs. The dominant may be one or more of several shrub species (*Bossiaea foliosa* in this photo taken in Long Plain (Kosciuszko NP), and the understorey is typically composed of grasses and forbs found in neighbouring grassland communities.

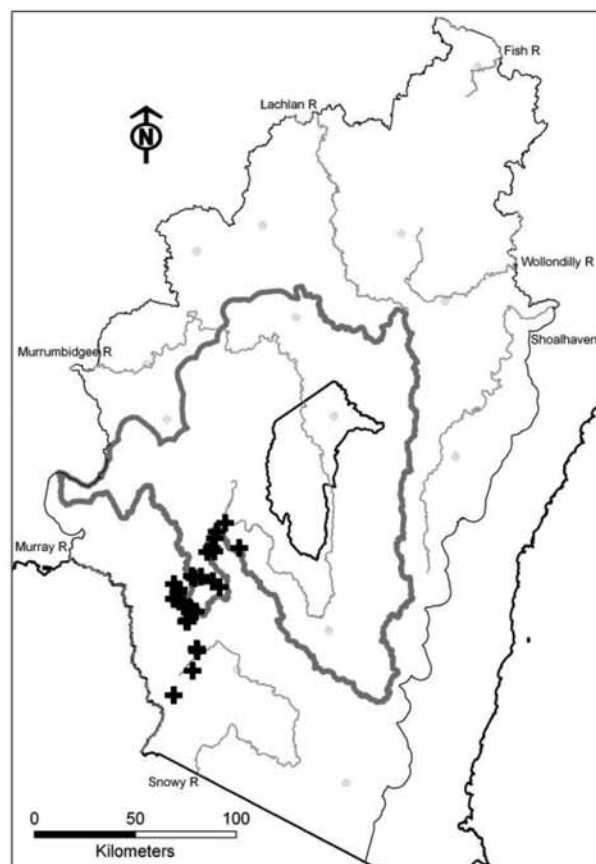


Fig. a33: Distribution of field samples assigned to this community.

<i>Erigeron bellidioides</i>	1	39	1	<1	P
<i>Euphrasia collina</i> subsp. <i>paludosa</i>	1	31	1	2	P
<i>Geranium antrorsum</i>	1	33	1	3	P
<i>Grevillea australis</i>	1	50	2	1	P
<i>Hakea microcarpa</i>	1	33	1	3	P
<i>Hovea montana</i>	2	50	1	<1	P
<i>Kunzea muelleri</i>	2	47	2	<1	P
<i>Leptorhynchos squamatus</i>	1	61	1	2	P
<i>Luzula modesta</i>	1	31	1	2	P
<i>Microseris lanceolata</i>	1	69	1	6	P
<i>Oreomyrrhis argentea</i>	1	33	1	<1	P
<i>Pimelea biflora</i>	1	36	1	<1	P
<i>Pimelea linifolia</i> subsp. <i>ceasia</i>	1	33	1	8	P
<i>Poa clivicola</i>	3	28	3	2	P
<i>Poa costiniana</i>	2	53	2	4	P
<i>Poa hiemata</i>	1	53	3	1	P
<i>Poranthera oreophila</i>	1	50	1	27	P
<i>Ranunculus graniticola</i>	1	83	1	3	P
<i>Scleranthus biflorus</i>	1	64	1	9	P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	44	1	3	P
<i>Trisetum spicatum</i>	1	31	1	2	P
<i>Xerochrysum subundulatum</i>	1	47	1	<1	P

Threatened communities: Nil.

Equivalent vegetation types: Combination of Communities 33 [Northern Alps *Hovea montana* open heathland], 35 [*Bossiaea foliosa* – *Epacris petrophila* heathland] and 36 [Broadway *Bossiaea foliosa* closed heathland] (McDougall & Walsh 2007); not clearly identified in other previous vegetation descriptions.

Frequently occurring weeds: *Acetosella vulgaris* (0.58), *Hypochaeris radicata* (0.36).

Threats: This community is frequently used by feral horses. Although trampling and selective grazing undoubtedly occur, the overall effect is likely to be minimal, because most shrubs in this community are unpalatable and facultative resprouters; in addition, most palatable species will be found in adjoining grassland. The greatest threat appears to be invasion by *Leucanthemum vulgare*. In an example of several hectares near Tantangara Dam, this weed has a cover of about 80%.

Reservation status: Mostly in conservation reserves (Kosciuszko NP, Bimberi NR, Namadgi NP), with small amounts on freehold land at Snowy Plain in the Southern Rivers CMA.

Extent of clearing: Probably negligible and this community appears to be expanding into grassland either because of past land use disturbance or climate change (or both).

Reference: McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

a39: *Epacris* sp. – *Pentachondra pumila* – *Poa fawcettiae* heathland of the Australian Alps bioregion

Scientific Name: *Epacris* sp. – *Pentachondra pumila* – *Poa fawcettiae* – *Senecio pectinatus* – *Craspedia maxgrayi*

Number of samples:	10
Richness [mean (±SD)]:	19 (4)
Slope (degrees):	(2) 6–10 (17)
Altitude (m asl):	(1729) 1936–2117 (2147)
Ave. Annual Rainfall (mm):	(2095) 2327–2581 (2634)
Temp. Annual Range (°C):	(19.7) 19.9–20.6 (21.6)

Vegetation Description: Community a39 is a low heathland dominated by an undescribed *Epacris* species (Costin et al. 2000), *Kunzea muelleri* or occasionally *Epacris petrophila*. It occurs on the upper granite or phyllite slopes and summits of the Kosciuszko Main Range, with an outlier on the summit of Mt. Jagungal. Sites containing this community

are generally rocky with shallow soil. An unusual feature of some stands is the presence of *Baeckea gunniana*, a species usually associated with moist sites. This species can sometimes be found layering over large granite boulders. The diversity and abundance of herb species is usually low. Rock and bare ground are common. This heathland has some floristic elements of Community 40 of McDougall & Walsh (2007; *Epacris gunnii* – *Chionohebe pulvinatus* fieldmark; e.g. *Leucochrysum alpinum* and *Luzula australasica*), but is far more diverse and lacking in low-growing species endemic to that community (*Colobanthus pulvinatus*, *Ranunculus acrophilus*, *Chionohebe densifolia*, *Euphrasia collina* subsp. *lapidosa*, *Kelleria dieffenbachii*).

On less exposed sites with deeper soil profiles, Community a39 often grades into Community a46 [*Prostanthera cuneata* – *Orites lancifolius* – *Nematolepis ovatifolia* heathland of the Australian Alps bioregion]. Community a39 is found in Murray and Southern Rivers catchments but may extend into the upper Murrumbidgee catchment area.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Aciphylla glacialis</i>	1	30	1	<1			P
<i>Acrothamnus montanus</i>	2	50	1	1			P
<i>Brachyscome tenuiscapa</i>	1	20	1	<1			P
<i>Carex breviculmis</i>	1	100	1	13			P
<i>Carex hebes</i>	1	30	1	1			P
<i>Celmisia costiniana</i>	1	80	1	1			P
<i>Craspedia aurantia</i>	1	60	1	1			P
<i>Craspedia costiniana</i>	1	40	1	<1			P
<i>Craspedia maxgrayi</i>	1	70	1	<1			P
<i>Deyeuxia carinata</i>	1	20	1	<1			P
<i>Deyeuxia crassiuscula</i>	1	30	1	<1			P
<i>Empodisma minus</i>	1	30	2	3			P
<i>Epacris</i> sp. (sensu Costin et al. 2000)	3	90	1	2			P
<i>Erigeron bellidioides</i>	1	30	1	1			P
<i>Erigeron nitidus</i>	1	30	1	<1			P
<i>Euphrasia collina</i> subsp. <i>diversicolor</i>	1	40	1	1			P
<i>Gentianella muelleriana</i> subsp. <i>alpestris</i>	1	30	1	<1			P
<i>Grevillea australis</i>	2	40	1	2			P
<i>Kunzea muelleri</i>	5	30	2	1			P
<i>Luzula alpestris</i>	1	40	1	<1			P
<i>Microseris lanceolata</i>	1	60	1	7			P
<i>Oreomyrrhis eriopoda</i>	1	80	1	13			P
<i>Pentachondra pumila</i>	1	70	1	<1			P
<i>Pimelea alpina</i>	1	50	1	1			P
<i>Poa costiniana</i>	2	40	2	5			P
<i>Poa fawcettiae</i>	2	50	3	2			P
<i>Poa hiemata</i>	3	20	2	2			P
<i>Prasophyllum</i> spp.	1	20	1	<1			P
<i>Rytidosperma nudiflorum</i>	1	60	1	2			P
<i>Saxipoa saxicola</i>	1	20	1	<1			P
<i>Senecio pectinatus</i> var. <i>major</i>	1	40	1	<1			P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	30	1	3			P
<i>Stackhousia pulvinaris</i>	1	20	1	<1			P
<i>Trisetum spicatum</i>	1	40	1	3			P

Threatened communities: Nil.

Equivalent vegetation types: *Epacris serpyllifolia* – *Kunzea muelleri* alliance (Costin 1954); a combination of the *Epacris microphylla* and *Kunzea muelleri* associations (McVean 1969); Community 39 [*Kosciuszko alpine Epacris* – *Kunzea open heathland*] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.30).

Threats: Some examples (e.g. summit of Mt. Kosciuszko) are subject to trampling pressure by tourists. The top stations of some lifts in NSW ski resorts are positioned within this community. The impact of these pressures on the overall community is currently low.



Plate a39: Community a39 is a low shrubland occurring on exposed sites in the Australian Alps, with a species-poor herbaceous component. This example is on the slopes of Mt Perisher, Kosciuszko NP.

Reservation status: Entirely within Kosciuszko NP.

Extent of clearing: Nil, but severely degraded by grazing prior to the 1950s.

References: Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57; McVean, D.N. (1969) Alpine vegetation of the central Snowy Mountains of New South Wales. *Journal of Ecology* 57: 67–86.

a42: *Epacris celata* – *Poa clivicola* – *Dillwynia palustris* grassy heathland of the Australian Alps bioregion

Scientific Name: *Epacris celata* – *Epacris gunnii* / *Poa clivicola* – *Deyeuxia gunniana* – *Cotula alpina* – *Lomandra aff. micrantha*.

Number of samples: 3
 Richness [mean (±SD)]: 26 (4)
 Slope (degrees): (0) 0–2 (3)
 Altitude (m asl): (1153) 1153–1155 (1156)
 Ave. Annual Rainfall (mm): (1367) 1369–1372 (1373)
 Temp. Annual Range (°C): (24.1) 24.2–24.2 (24.2)

Vegetation Description: Community a42 is a grassy heathland comprising very short plants of *Epacris celata* and *Epacris gunnii*. In stature and abundance, the shrubs are less prominent than the grasses (*Poa clivicola*, *Poa sieberiana* and *Themeda australis*), which makes the community appear more like a grassland than an open heathland. This community is not closely related to any of the other communities in the upper Murrumbidgee catchment. It is considered rare and isolated from other treeless vegetation in the Australian Alps bioregion.

This community is currently recorded only from McPhersons Plain, part of a high plateau on the western side of the Tumut Valley to the west of Kosciuszko NP. Considering that other treeless plains on the plateau nearby (Sparks Plain and Tomneys Plain) have not been surveyed, it is likely that it is not restricted to McPhersons Plain.

Adjoining communities include Community u22 [*Mountain Gum* – *Snow Gum* grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions] on upper slopes, Community a2 [*Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)] in areas of impeded drainage, and Community a14 [*Poa costiniana* – *Carex gaudichaudiana* subalpine valley grassland of the Australian Alps bioregion], as well as Community a9 [*Carex gaudichaudiana* – *Ranunculus amphitrichus* – *Phragmites australis* aquatic herbfield of waterways in the Australian Alps and South Eastern Highlands bioregions] along waterways. Examples of Community a6 [*Ranunculus millanii* – *Lobelia surrepens* – *Carex gaudichaudiana* herbfield of shallow depressions in the Australian Alps bioregion] are scattered within the community.

Characteristic Species:

Species	C/A	Freq	C/A	OFreq	O	Fid
<i>Asperula gunnii</i>	1	67	1	5		P
<i>Baloskion australe</i>	1	33	1	2		P
<i>Brachyscome decipiens</i>	1	67	1	2		P
<i>Brachyscome scapigera</i>	1	100	1	2		P
<i>Bulbine bulbosa</i>	1	67	1	4		P
<i>Caesia alpina</i>	1	33	1	<1		P
<i>Carex hebes</i>	1	33	1	2		P
<i>Cotula alpina</i>	1	100	1	1		P

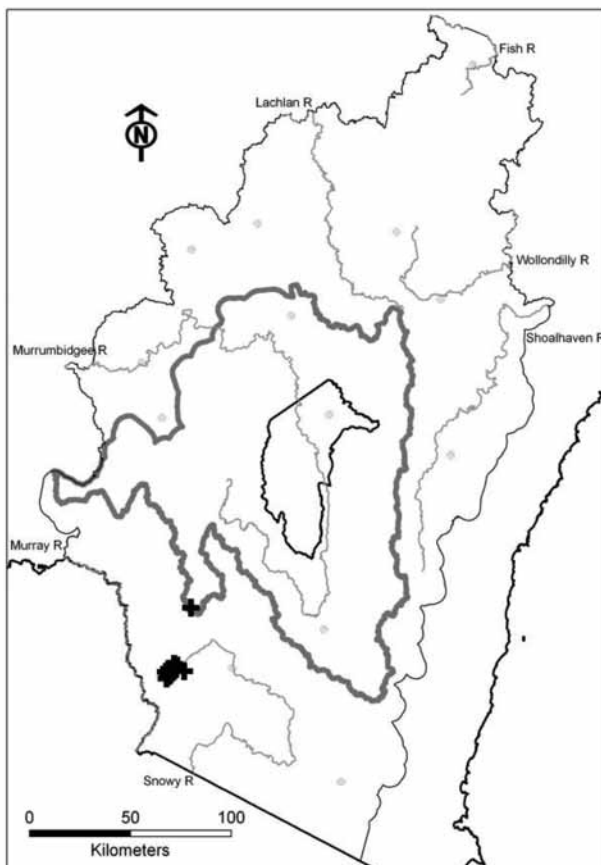


Fig. a39: Distribution of field samples assigned to this community.

<i>Deyeuxia crassiuscula</i>	1	33	1	<1	P
<i>Deyeuxia gunniana</i>	1	100	1	<1	P
<i>Dillwynia palustris</i>	2	33	1	<1	P
<i>Diuris monticola</i>	1	33	1	<1	P
<i>Diuris</i> spp.	1	33	1	<1	P
<i>Empodisma minus</i>	1	67	2	4	P
<i>Epacris celata</i>	3	100	2	<1	P
<i>Epacris gunnii</i>	3	100	1	2	P
<i>Erigeron bellidioides</i>	1	33	1	1	P
<i>Euphrasia collina</i> subsp. <i>paludosa</i>	2	100	1	2	P
<i>Gonocarpus micranthus</i>	1	67	1	2	P
<i>Hakea microcarpa</i>	1	67	1	3	P
<i>Hydrocotyle sibthorpioides</i>	1	67	2	5	P
<i>Hypericum japonicum</i>	1	67	1	4	P
<i>Lomandra</i> aff. <i>micrantha</i>	1	67	2	<1	P
<i>Oreobolus distichus</i>	1	33	1	<1	P
<i>Pimelea biflora</i>	1	33	1	<1	P
<i>Plantago euryphylla</i>	1	33	1	1	P
<i>Poa clivicola</i>	5	67	3	2	P
<i>Prasophyllum</i> spp.	1	67	1	<1	P
<i>Pultenaea polifolia</i>	1	33	1	<1	P
<i>Ranunculus graniticola</i>	1	100	1	4	P
<i>Stylidium montanum</i>	2	100	1	25	P
<i>Carex breviculmis</i>	1	67	1	13	C
<i>Luzula flaccida</i>	1	67	1	13	C
<i>Poa sieberiana</i>	3	67	2	48	C
<i>Poranthera oreophila</i>	2	67	1	27	C
<i>Themeda australis</i>	1	67	2	21	C



Plate a42: Community a42 at McPhersons Plain, Kosciuszko NP. It is a grassy heathland which may be dominated by *Epacris* spp. or *Poa* species depending on time since disturbance (e.g. by grazing). It is confined to the plains in and around Bago State Forest, between Talbingo and Tumbarumba.

Threatened communities: Nil.

Equivalent vegetation types: Community 42 [*Epacris celata* – *Poa clivicola* open heathland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Cerastium vulgare* (0.33), *Holcus lanatus* (0.33), *Hypochaeris radicata* (0.67), *Poa pratensis* (0.33), *Trifolium repens* (0.67).

Threats: Some of the community is the subject of a conservation agreement that fosters management of the vegetation for its significant biodiversity features. Despite this, the community is threatened overall by feral animals, stray domestic stock from neighbouring properties and future changes in land use.

Reservation status: Not present in a conservation reserve. McPhersons Plain is partly in a State Forest lease and partly freehold. Treeless plains nearby are freehold.

Extent of clearing: Nil, but probably locally degraded by historic grazing practices.

References: McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

a43: *Bossiaea riparia* – *Themeda australis* low open heathland of the Australian Alps bioregion

Scientific Name: *Bossiaea riparia* – *Cryptandra amara* – *Hakea microcarpa* – *Dillwynia prostrata* / *Themeda australis*

Number of samples:	3
Richness [mean (±SD)]:	23 (5)
Slope (degrees):	(3) 6–12 (15)
Altitude (m asl):	(1198) 1209–1254 (1289)
Ave. Annual Rainfall (mm):	(968) 971–980 (986)
Temp. Annual Range (°C):	(24.5) 24.7–24.9 (25)

Vegetation Description: Community a43 is an open heathland characterised by an extensive cover of a prostrate form of the shrub *Bossiaea riparia* and much exposed rock. The associated flora is variable and may depend on the amount of soil present and the composition

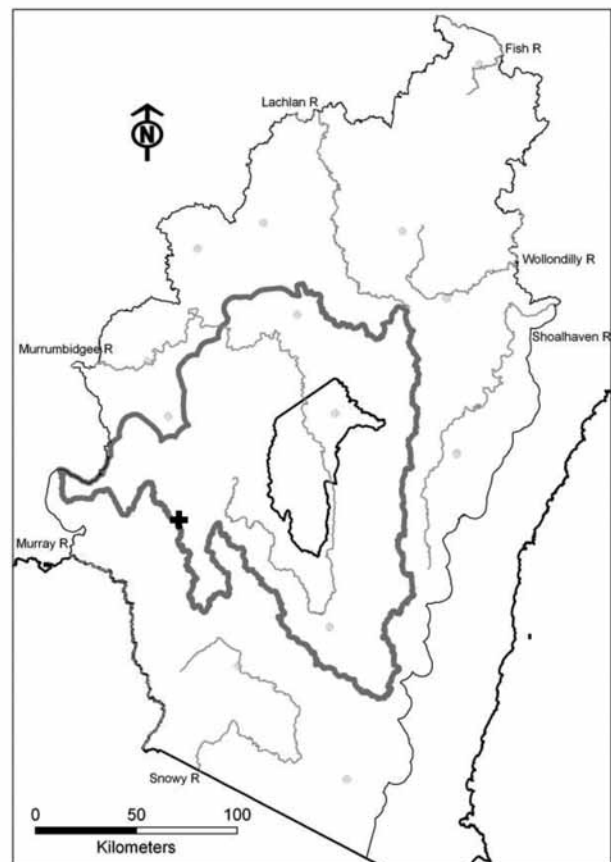


Fig. a42: Distribution of field samples assigned to this community.

of surrounding communities. Despite its variability, the community has few affinities with other communities. Of communities present in treeless subalpine plains, five species were restricted to Community a43 or very rare elsewhere (*Bossiaea riparia*, *Cryptandra amara*, *Daviesia mimosoides* subsp. *acris*, *Mirbelia oxylobioides*, *Patersonia sericea* var. *longifolia*). *Patersonia sericea* var. *longifolia* is otherwise unknown in the Australian Alps bioregion.

This community is endemic to the upper Murrumbidgee catchment, being restricted to the rocky slopes above the upper Murrumbidgee River, and a few of its tributaries (in the vicinity of Currango Plain and Tantangara Dam). It possibly occurs at lower elevations in the Yaouk valley. It is typically found amongst Community a30 [*Poa hookeri* – *Poa clivicola* – *Oreomyrrhis argentea* – *Ranunculus graniticola* grassland of the Australian Alps bioregion] and sometimes in association with Community a34 [*Weeping Snow Gum* – *Small-fruited Hakea* – *Blue Snow-grass* grassy open woodland of the Australian Alps bioregion].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Agrostis venusta</i>	1	33	1	<1			P
<i>Australopyrum velutinum</i>	1	33	1	<1			P
<i>Austrostipa nivicola</i>	1	33	1	<1			P
<i>Bossiaea riparia</i>	2	100	1	<1			P
<i>Calotis glandulosa</i>	2	33	1	<1			P
<i>Carex hebes</i>	1	33	1	2			P
<i>Cassinia monticola</i>	1	33	1	1			P
<i>Craspedia aurantia</i>	1	33	1	2			P
<i>Cryptandra amara</i>	1	67	1	1			P
<i>Dillwynia prostrata</i>	4	67	2	<1			P
<i>Diuris monticola</i>	1	67	1	<1			P
<i>Epilobium billardierianum</i>	1	67	1	2			P
<i>Festuca muelleri</i>	1	33	1	<1			P
<i>Hakea microcarpa</i>	1	100	1	3			P
<i>Luzula novae-cambriae</i>	1	33	1	<1			P
<i>Patersonia sericea</i> var. <i>longifolia</i>	2	33	2	1			P
<i>Pimelea linifolia</i> subsp. <i>caesia</i>	1	100	1	8			P
<i>Pimelea pauciflora</i>	1	33	1	<1			P
<i>Poa clivicola</i>	2	67	3	2			P
<i>Poa hookeri</i>	3	33	3	<1			P
<i>Podolepis jaceoides</i>	1	67	1	1			P
<i>Pultenaea subspicata</i>	2	33	2	2			P
<i>Rhodanthe anthemoides</i>	1	33	1	1			P
<i>Rutidosia leiolepis</i>	2	33	2	<1			P
<i>Rytidosperma erianthum</i>	1	33	2	1			P
<i>Saxipoa saxicola</i>	1	33	1	<1			P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	67	1	3			P
<i>Themeda australis</i>	1	100	2	21			P
<i>Trisetum spicatum</i>	1	67	1	3			P
<i>Xerochrysum subundulatum</i>	1	33	1	1			P
<i>Carex breviculmis</i>	1	67	1	13			C
<i>Euchiton japonicus</i>	1	67	1	15			C
<i>Luzula flaccida</i>	1	67	1	13			C
<i>Microlaena stipoides</i>	1	67	2	34			C

Threatened communities: Nil.

Equivalent vegetation types: Community 43 [*Bossiaea riparia* dwarf heathland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.33), *Agrostis capillaris* (0.33), *Aira caryophyllea* (0.33), *Anthoxanthum odoratum* (0.33), *Hypericum perforatum* (0.33), *Hypochaeris radicata* (1.00), *Vulpia bromoides* (0.33).

Threats: None obvious.

Reservation status: All known examples occur within Kosciuszko NP.



Plate a43: Community a43 (left hand side adjoining a30) is a low shrubland dominated by *Bossiaea riparia* and confined to the upper Murrumbidgee valley in the vicinity of Tantangara Dam (Kosciuszko NP, this photo) and Currango Plain.

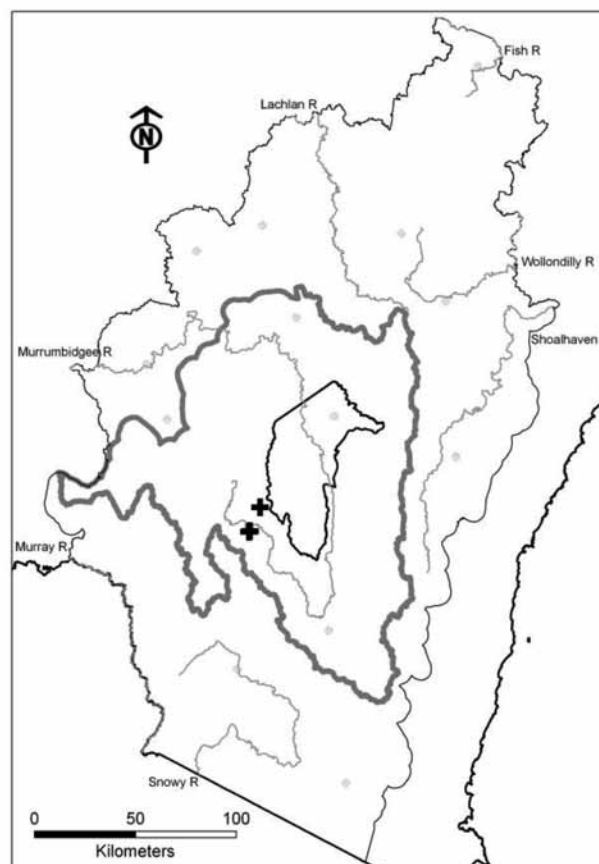


Fig. a43: Distribution of field samples assigned to this community.

Extent of clearing: Unknown but probably nil. Many examples on the steep slopes of the Murrumbidgee River at Gulf Bend are sparsely vegetated and may be recovering from past disturbance associated with domestic grazing.

References: McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

a46: *Prostanthera cuneata* – *Orites lancifolius* – *Nematolepis ovatifolia* heathland of the Australian Alps bioregion

Scientific Name: *Nematolepis ovatifolia* – *Orites lancifolius* – *Prostanthera cuneata* – *Olearia brevipedunculata* – *Grevillea australis*

Number of samples:	17
Richness [mean (±SD)]:	22 (7)
Slope (degrees):	(1) 5–12 (18)
Altitude (m asl):	(1635) 1749–1945 (2009)
Ave. Annual Rainfall (mm):	(1851) 2075–2296 (2438)
Temp. Annual Range (°C):	(20.2) 20.6–21.5 (21.7)

Vegetation Description: Community a46 is a shrubland dominated by species such as *Nematolepis ovatifolia*, *Orites lancifolia* and/or *Prostanthera cuneata*. Other shrubs such as *Grevillea australis*, *Hovea montana*, *Kunzea muelleri* and *Oxylobium ellipticum* may be locally abundant. Shrub cover is sparse at its upper altitudinal limits and closed at its lower. Its distribution is scattered and common on the dry slopes of the Kosciuszko Main Range between Dead Horse Gap (near Thredbo) and Mt. Jagungal.

Community a46 is a combination of two shrub-dominated communities described by McDougall & Walsh (2007), representing a continuum from near the treeline, where shrubs are tall and closed with a sparse herb cover, to the alpine zone, where shrubs are shorter and gaps between shrubs are filled with species characteristic of Community a22 [*Poa fawcettiae* – *Celmisia costiniana* – *Craspedia maxgrayi* grassland of the Australian Alps bioregion]. At their boundaries, these communities are probably inseparable. At its lower extent, community a46 grades into Community u158 [*Alpine Sallee shrub-grass subalpine mid-high woodland of the Australian Alps bioregion*].

There are outliers in the upper Murrumbidgee catchment in the upper Tumut valley and at Kiandra. The Kiandra example contains the northern-most population of *Phebalium squamulosum* subsp. *alpinum*.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O	Fid
<i>Aciphylla simplicifolia</i>	1	24	1	2		P
<i>Acrothamnus montanus</i>	1	29	1	1		P
<i>Argyrotegium fordianum</i>	1	24	1	<1		P
<i>Asperula gunnii</i>	1	41	1	5		P
<i>Carex breviculmis</i>	1	82	1	13		P
<i>Celmisia costiniana</i>	2	24	1	1		P
<i>Celmisia pugioniformis</i>	1	47	1	2		P
<i>Craspedia aurantia</i>	1	65	1	1		P
<i>Deyeuxia crassiuscula</i>	1	24	1	<1		P
<i>Empodisma minus</i>	1	24	2	3		P
<i>Erigeron bellidioides</i>	1	35	1	1		P
<i>Erigeron nitidus</i>	1	59	1	<1		P
<i>Euphrasia collina</i> subsp. <i>diversicolor</i>	1	29	1	1		P
<i>Gonocarpus montanus</i>	1	24	1	1		P
<i>Grevillea australis</i>	2	82	1	1		P
<i>Leptorhynchus squamatus</i>	2	24	1	3		P
<i>Luzula alpestris</i>	1	24	1	<1		P
<i>Luzula modesta</i>	1	29	1	2		P



Plate a46: Sheltered sites with shallow soils and exposed rock at high elevation in Kosciuszko NP are typically shrub-dominated with a very sparse understorey of herbs; this example near Mt Blue Cow, Kosciuszko NP.

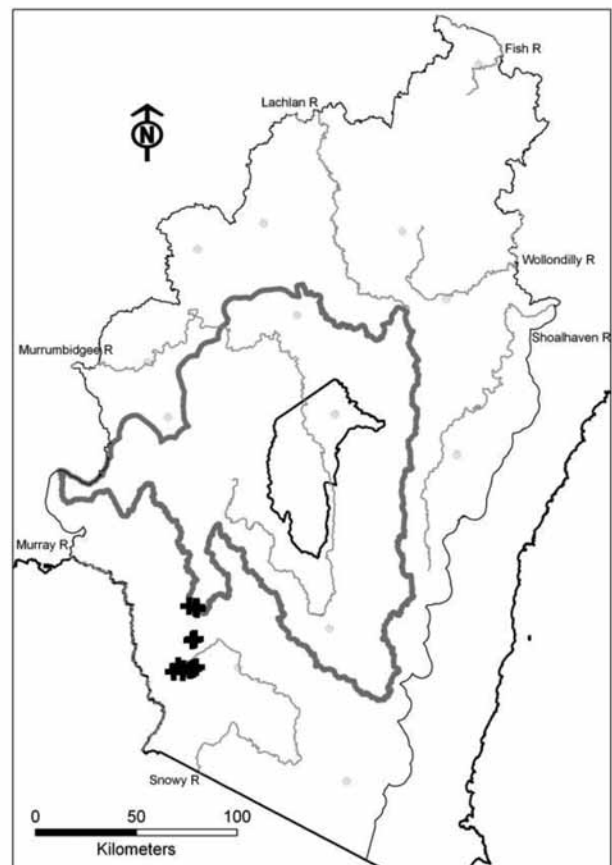


Fig. a46: Distribution of field samples assigned to this community.

<i>Lycopodium fastigiatum</i>	1	29	1	<1	P
<i>Melicytus</i> sp. 'Snowfields'	1	53	1	3	P
<i>Microseris lanceolata</i>	1	47	1	7	P
<i>Nematolepis ovatifolia</i>	3	82	2	<1	P
<i>Olearia algida</i>	1	29	1	<1	P
<i>Olearia brevipedunculata</i>	1	29	1	<1	P
<i>Olearia phlogopappa</i>	1	24	1	3	P
<i>Oreomyrrhis eriopoda</i>	1	65	1	13	P
<i>Orites lancifolius</i>	3	24	2	<1	P
<i>Oxylobium ellipticum</i>	2	29	1	4	P
<i>Pimelea alpina</i>	1	71	1	1	P
<i>Plantago euryphylla</i>	1	41	1	<1	P
<i>Poa costiniana</i>	2	29	2	5	P
<i>Poa fawcettiae</i>	4	35	3	2	P
<i>Poa hiemata</i>	3	65	2	1	P
<i>Prostanthera cuneata</i>	2	53	2	<1	P
<i>Ranunculus graniticola</i>	1	41	1	4	P
<i>Rytidosperma nudiflorum</i>	1	41	1	2	P
<i>Scleranthus biflorus</i>	1	41	1	10	P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	35	1	3	P
<i>Trisetum spicatum</i>	1	41	1	2	P
<i>Viola betonicifolia</i>	1	53	1	27	C

Threatened communities: Nil.

Equivalent vegetation types: part of *Oxylobium ellipticum* – *Podocarpus alpinus* alliance (Costin 1954); *Phebalium ovatifolium* association (McVean 1969); part of *Heath* formation (Costin et al. 2000); combination of communities 23 [*Grevillea australis* – *Nematolepis ovatifolia* open heathland] and 46 [*Nematolepis ovatifolia* – *Prostanthera cuneata* closed heathland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.65).

Threats: None obvious. This community is apparently expanding either under the influence of climate change or because of past disturbance from grazing. Much of this community was burnt in 2003, but regeneration of most species seems to have occurred (Walsh & McDougall 2005).

Reservation status: All within Kosciuszko NP.

Extent of clearing: Nil.

References: Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); Costin, A.B., Gray, M., Totterdell, C.J. & Wimbush D.J. (2000) Kosciuszko alpine flora. (CSIRO Publishing: Collingwood); McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57; McVean, D.N. (1969) Alpine vegetation of the central Snowy Mountains of New South Wales. *Journal of Ecology* 57: 67–86.

a51: *Podocarpus lawrencei* – *Rytidosperma alpicola* – *Brachyscome nivalis* low open heathland of rock outcrops of the Australian Alps bioregion

Scientific Name: *Podocarpus lawrencei* – *Grevillea australis* / *Rytidosperma alpicola* – *Brachyscome nivalis* – *Polystichum proliferum*

Number of samples:	5
Richness [mean (±SD)]:	22 (7)
Slope (degrees):	(9) 15–22 (30)
Altitude (m asl):	(1911) 2029–2076 (2153)
Ave. Annual Rainfall (mm):	(2316) 2322–2576 (2653)
Temp. Annual Range (°C):	(19.7) 20–20.2 (20.7)

Vegetation Description: Community a51 is a low sparse shrubland dominated by *Rytidosperma alpicola*, with sparse shrubs including *Podocarpus lawrencei*, *Prostanthera cuneata*, *Melicytus* sp. 'Snowfields'

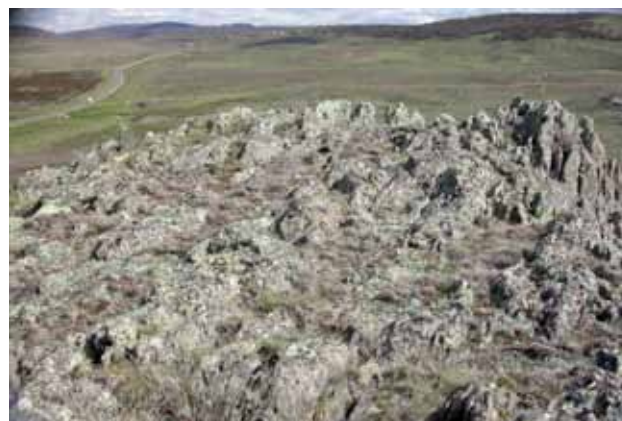


Plate a51: Rocky outcrops with skeletal soils in subalpine and alpine parts of Kosciuszko NP usually have a sparse cover of herbs and low shrubs. This example is at Kiandra in Kosciuszko NP where the shrub component was temporarily removed by the 2003 fire.

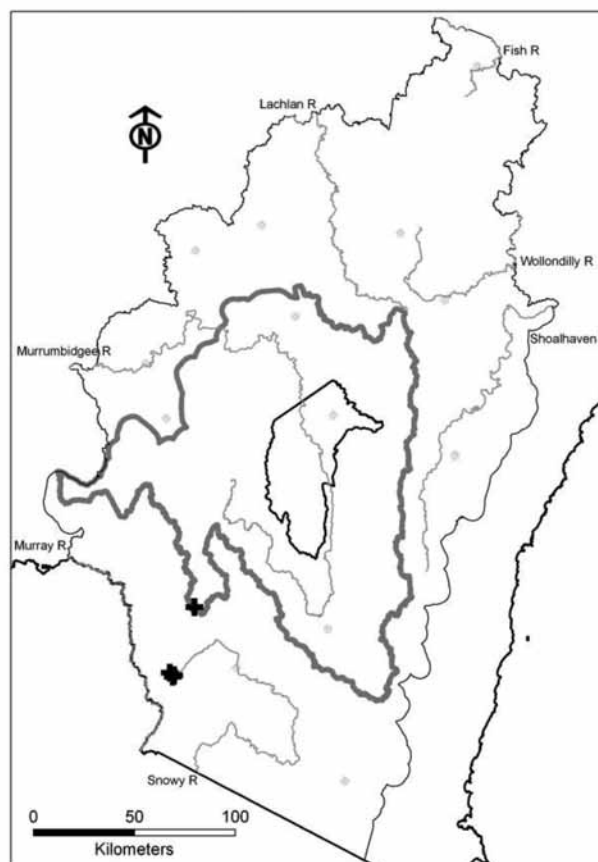


Fig. a51: Distribution of field samples assigned to this community.

and *Acrothamnus montanus*. Plant cover is generally minimal. This community occurs on cliffs and other rocky outcrops from Mt. Buller in Victoria to Kiandra in NSW. It is especially common on the higher peaks of the Kosciuszko Main Range and the Mt. Jagungal area. Herbs and sedges such as *Brachyscome nivalis*, *Brachyscome rigidula*, *Crassula sieberiana* and *Luzula novae-cambriae* occur in most examples and are rarely found in other communities in the Australian Alps bioregion.

Characteristic Species:

Species	C/A	Freq	C/AO	FreqO	Fid
<i>Aciphylla glacialis</i>	1	20	1	<1	P
<i>Acrothamnus montanus</i>	1	80	1	1	P
<i>Argyrotegium fordianum</i>	1	20	1	<1	P
<i>Argyrotegium mackayi</i>	1	20	1	<1	P
<i>Asperula pusilla</i>	1	20	1	<1	P
<i>Brachyscome nivalis</i>	1	40	1	<1	P
<i>Celmisia pugioniformis</i>	2	40	1	2	P
<i>Craspedia adenophora</i>	1	20	1	<1	P
<i>Craspedia aurantia</i>	1	40	1	2	P
<i>Craspedia maxgrayi</i>	1	20	1	<1	P
<i>Deyeuxia crassiuscula</i>	1	60	1	<1	P
<i>Epilobium billardierianum</i>	1	60	1	2	P
<i>Erigeron nitidus</i>	1	20	1	<1	P
<i>Ewartia nubigena</i>	1	60	1	<1	P
<i>Gentianella muelleriana</i> subsp. <i>alpestris</i>	1	20	1	<1	P
<i>Luzula novae-cambriae</i>	1	20	1	<1	P
<i>Lycopodium fastigiatum</i>	1	40	1	<1	P
<i>Melicytus</i> sp. 'Snowfields'	1	60	1	3	P
<i>Microseris lanceolata</i>	1	60	1	7	P
<i>Nematolepis ovatifolia</i>	2	40	3	<1	P
<i>Olearia brevipedunculata</i>	1	20	1	<1	P
<i>Oreomyrrhis brevipes</i>	1	20	0	0	P
<i>Oreomyrrhis eriopoda</i>	1	80	1	13	P
<i>Ozothamnus secundiflorus</i>	1	20	1	<1	P
<i>Poa costiniana</i>	1	60	2	5	P
<i>Poa fawcettiae</i>	3	60	3	2	P
<i>Podocarpus lawrencei</i>	2	80	2	<1	P
<i>Polystichum proliferum</i>	1	80	1	7	P
<i>Prostanthera cuneata</i>	2	40	2	<1	P
<i>Rytidosperma alpicola</i>	1	100	1	<1	P
<i>Rytidosperma nudiflorum</i>	1	40	1	2	P
<i>Saxipoa saxicola</i>	1	20	1	<1	P
<i>Scleranthus singuliflorus</i>	1	60	1	<1	P
<i>Senecio pectinatus</i> var. <i>major</i>	1	20	1	<1	P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	60	1	3	P
<i>Trisetum spicatum</i>	1	60	1	3	P
<i>Acaena novae-zelandiae</i>	1	40	1	28	C
<i>Carex breviculmis</i>	1	60	1	13	C
<i>Crassula sieberiana</i>	1	40	1	6	C
<i>Viola betonicifolia</i>	1	80	1	27	C

Threatened communities: Nil.

Equivalent vegetation types: *Brachycome nivalis* – *Danthonia alpicola* alliance (Costin 1954); *Poa hothamensis* (rocky) grassland, Unit 13 (McDougall 1982); *Brachyscome* – *Austrodanthonia* tall alpine herbfield (Costin et al. 2000); Community 51 [*Austrodanthonia alpicola* – *Grevillea australis* open heathland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.80), *Hypochaeris radicata* (0.40).

Threats: Examples of this community occurring on cliffs above Blue Lake in Kosciuszko NP are possibly threatened by recreational rock climbers. Elsewhere, it may be damaged by tourists accessing rocky outcrops for better views, but the overall threat to the community from these activities is currently low.

Reservation status: Likely to be entirely within Kosciuszko NP.

Extent of clearing: Nil.

References: Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); Costin, A.B., Gray, M., Totterdell, C.J. & Wimbush D.J. (2000) Kosciuszko alpine flora. (CSIRO Publishing: Collingwood); McDougall, K.L. (1982) The alpine vegetation of the Bogong high plains. Environmental studies publication no. 357. Ministry for Conservation: Melbourne; McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

a54: *Podocarpus lawrencei* – *Pimelea ligustrina* subsp. *ciliata* heathland of screes and boulder-fields of the Australian Alps bioregion

Scientific Name: *Podocarpus lawrencei* – *Pimelea ligustrina* subsp. *ciliata* / *Polystichum proliferum*

Number of samples:	2
Richness [mean (±SD)]:	15 (6)
Slope (degrees):	(6) 7–8 (8)
Altitude (m asl):	(1766) 1798–1861 (1892)
Ave. Annual Rainfall (mm):	(2062) 2096–2164 (2198)
Temp. Annual Range (°C):	(20.7) 20.9–21.3 (21.5)

Vegetation Description: Community a54 is a closed shrubland dominated by *Podocarpus lawrencei*. It occurs in areas of minimal soil development and abundant boulders in the alpine and subalpine areas of Victoria (Bogong High Plains, Mt. Hotham area, Mt. Howitt, Mt. Buffalo, Cobberas and Crosscut Saw) and NSW (between Mt. Kosciuszko and Mt. Jagungal, and the steep slopes of the Tumut valley in the vicinity of Cabramurra). Scree slopes containing *Podocarpus lawrencei* in the ACT may also be referable to this community, but further sampling is required to confirm this. Examples have been recorded on metamorphic substrates, where *Podocarpus lawrencei* layers over large rock slabs, on granite boulder streams and outcrops and on basalt scree. The species composition of plots depends on the location of drainage features, which often pass under the boulders. Species characteristic of wetlands (e.g. *Richea continentis*) may therefore be found in damp parts of the community. Species richness is commonly low, and in sites with large rocks and no exposed soil there may be only a few species per plot.

This community is highly restricted and usually found in screes and boulder fields amongst Community u158 [*Alpine Sallee shrub-grass subalpine mid-high woodland of the Australian Alps bioregion*] or Community a46 [*Prostanthera cuneata* – *Orites lancifolius* – *Nematolepis ovatifolia* heathland of the Australian Alps bioregion]. After the 2003 fires, the diversity of many burnt *Podocarpus lawrencei* heathlands increased. *Pelargonium helmsii*, a species rarely recorded prior to 2003, was found to be common in many burnt *Podocarpus lawrencei* dominated heathlands in Kosciuszko NP. A population of *Senecio velleioides*, normally a wet sclerophyll forest species occurring from the central coast in NSW south to Tasmania, was located in this community two years after the fire at 1880 metres above sea level on Blue Cow Mountain. This was the first record for this species in treeless vegetation in the Australian Alps bioregion. The community is the primary habitat for the Mountain Pygmy-possum (*Burramys parvus*), an endangered marsupial.

Characteristic Species:

Species	C/A	Freq	C/AO	FreqO	Fid
<i>Argyrotegium fordianum</i>	1	50	1	<1	P
<i>Baeckea gunniana</i>	2	50	2	1	P
<i>Epilobium billardierianum</i>	1	50	1	2	P
<i>Erigeron nitidus</i>	1	100	1	<1	P
<i>Grevillea australis</i>	2	50	2	2	P

<i>Lycopodium fastigiatum</i>	1	50	1	<1	P
<i>Nematolepis ovatifolia</i>	2	100	3	<1	P
<i>Olearia brevipedunculata</i>	1	50	1	<1	P
<i>Olearia phlogopappa</i>	1	50	1	3	P
<i>Orites lancifolius</i>	2	100	3	<1	P
<i>Pimelea axiflora</i> subsp. <i>alpina</i>	1	50	1	<1	P
<i>Pimelea ligustrina</i> subsp. <i>ciliata</i>	1	100	1	<1	P
<i>Poa hiemata</i>	1	50	2	2	P
<i>Podocarpus lawrencei</i>	4	100	2	<1	P
<i>Polystichum proliferum</i>	1	100	1	7	P
<i>Prostanthera cuneata</i>	3	100	2	<1	P
<i>Richea continentis</i>	1	50	2	<1	P
<i>Carex breviculmis</i>	1	50	1	13	C
<i>Deyouxia monticola</i>	1	50	1	6	C
<i>Oreomyrrhis eriopoda</i>	1	50	1	13	C
<i>Senecio gunnii</i>	1	50	1	9	C

Threatened communities: Nil, but possibly eligible for listing.

Equivalent vegetation types: part of *Oxylobium ellipticum* – *Podocarpus alpinus* alliance (Costin 1954); *Podocarpus lawrencei* association (McVean 1969); *Podocarpus* heathland, Unit 1 (McDougall 1982); *Podocarpus* heathland, subcommunity 1.1 (Walsh et al. 1984); Community 54 [*Podocarpus lawrencei* closed heathland] (McDougall & Walsh 2007).

Frequently occurring weeds: *Acetosella vulgaris* (0.5).

Threats: Surveys of regeneration following the 2003 fires suggest that recovery of many stands will be slow and patchy, and some may not recover at all in the short term. Basal regeneration of *Podocarpus lawrencei* has been observed in some populations in the ACT and the Cobberas in Victoria (Carey et al. 2003, Tolsma et al. 2004) but none appears to have occurred in Kosciuszko NP (Williams et al. 2008). Resprouting of partially burnt stems did occur throughout its range but it tended to be rare and much of the regeneration subsequently died. Seedlings were observed in the summer following the fire, but these have been rare or patchy at some sites.

Dendrochronological research on *Podocarpus lawrencei* indicates that plants are up to 400 years old (McDougall et al. 2012). Since the plants are obligate seeders (in NSW at least), catastrophic fires must be rare in this community. Too frequent fire is therefore a grave threat to this community and the Mountain Pygmy-possum.

Reservation status: All within Kosciuszko NP.

Extent of clearing: Nil.

References: Carey, A., Evans, M., Hann, P., Lintermans, M., MacDonald, T., Ormay, P., Sharp, S., Shorthouse, D. & Webb, N. (2003) Wildfires in the ACT 2003: Report on initial impacts on natural ecosystems. Technical Report 17, Wildlife Research and Monitoring, Environment ACT, Canberra; Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); McDougall, K.L. (1982) The alpine vegetation of the Bogong high plains. Environmental studies publication no. 357. Ministry for Conservation: Melbourne; McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57; McDougall, K.L., Brookhouse, M. & Broome, L.S. (2012) Dendroclimatological investigation of mainland Australia's only alpine conifer, *Podocarpus lawrencei* Hook.f. *Dendrochronologia* 30: 1–9; McVean, D.N. (1969) Alpine vegetation of the central Snowy Mountains of New South Wales. *Journal of Ecology* 57: 67–86; Tolsma, A., Coates, F. & Sutter, G. (2004) Recovery of Mountain Plum-Pine Shrubland After Fire (Cobberas). Arthur Rylah Institute for Environmental Research Technical Report No. 153. Department of Sustainability and Environment, Victoria; Walsh, N.G., Barley, R.H. & Gullan, P.K. (1984) The alpine vegetation of Victoria (excluding the Bogong high plains), volume 1. Environmental studies publication no. 376. Department of Conservation, Forests and Lands: Melbourne; Williams, R.J., Wahren, C-H., Tolsma, A.D., Sanecki, G.M., Papst, W.A., Myers, B.A., McDougall, K.L., Heinze, D.A. & Green, K. (2008) Large fires in Australian alpine landscapes: their part in the historical fire regime and their impacts on alpine biodiversity. *International Journal of Wildland Fire* 17: 793–808.



Plate a54: Periglacial activity has resulted in the deposition of extensive piles of boulders (of granite or basalt) in Kosciuszko NP. Community a54, dominated by *Podocarpus lawrencei*, is characteristic of this habitat; this example on basalt near Happy Jacks Plain.

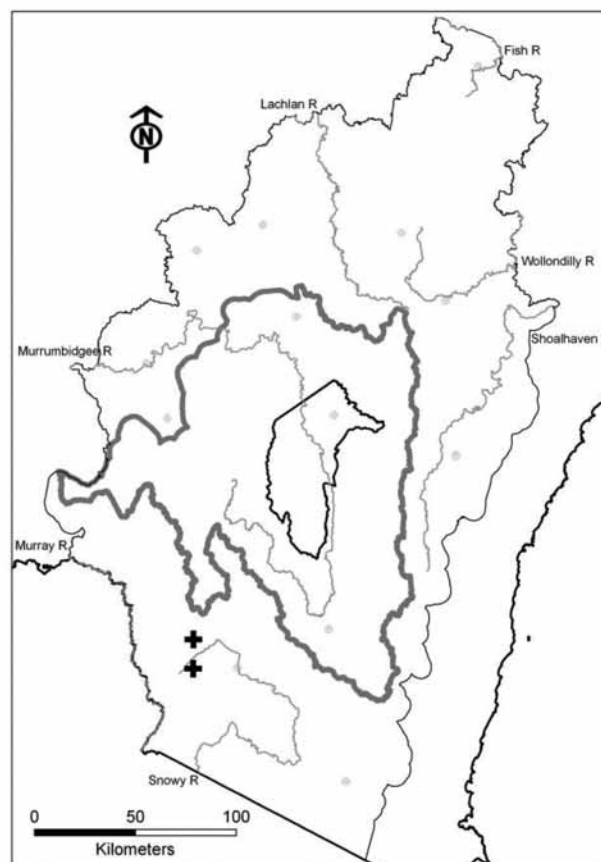


Fig. a54: Distribution of field samples assigned to this community.

g36: *Leptospermum micromyrtus* – *Kunzea muelleri* – *Kunzea ericoides* dry heathland on skeletal ridges primarily of the Namadgi region

Scientific Name: *Leptospermum micromyrtus* – *Kunzea muelleri* – *Kunzea ericoides* / *Carex breviculmis* – *Gonocarpus tetragynus*

Number of samples:	8
Richness [mean (±SD)]:	15 (4)
Slope (degrees):	(3) 11–23 (30)
Altitude (m asl):	(1123) 1370–1461 (1634)
Ave. Annual Rainfall (mm):	(928) 1043–1137 (1357)
Temp. Annual Range (°C):	(22.1) 23.4–23.9 (25.2)

Vegetation Description: Community g36 is a dense shrubland interspersed with large expanses of unvegetated rock outcrop. Dominant species include *Leptospermum micromyrtus*, *Kunzea ericoides*, *Calytrix tetragona*, *Kunzea muelleri* and *Leionema lamprophyllum*. *Epacris robusta* and *Oxylobium ellipticum* may also be locally common, and *Eucalyptus cinerea* subsp. *triplex* is an emergent (up to 10 metres tall) at one site. *Carex breviculmis*, *Veronica perfoliata*, *Gonocarpus tetragynus* and *Poa* spp. are common ground cover elements. Species such as *Pelargonium australe*, *Trachymene composita* and the endangered *Dampiera fusca* are likely to be ephemeral components that increase in abundance after fire.

This community has been recorded on granite outcrops at Booroomba Rocks in the ACT, the NSW side of Mt. Coree on the NSW / ACT border (Brindabella NP) and in Yaouk NR in NSW. It was identified as *Montane / Sub-Alpine Dry Rocky Shrubland* by Gellie (2005). Modelling by Gellie (2005), which suggested that the community extends from the ACT to the higher parts of Kosciuszko NP to the south-west (in the vicinity of the Main Range), is not supported by subsequent plot sampling. While the exact distribution of this community is uncertain because of undersampling (a consequence of the remoteness of the areas in which it occurs), the distribution of one of its character species gives a clue to the likely distribution. The variant of *Asterolasia trymalioides* that occurs in this community is likely to be recognized at subspecific rank (K. McDougall, OEH, pers. comm.). It is found at Booroomba Rocks in Namadgi NP and granite outcrops along the ACT / NSW border (e.g. Mt. Kelly, Mt. Scabby) to Yaouk NR. This variant also occurs in Tinderry NR (Twin Peaks) in similar habitat and with many of the characteristic species listed below, however its relationship to this plant community has not been investigated through plot sampling.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Asterolasia</i> aff. <i>trymalioides</i>	2	25	2	<1	P
<i>Baeckea utilis</i>	1	25	2	2	P
<i>Bulbine glauca</i>	1	25	1	<1	P
<i>Callistemon pallidus</i>	1	25	1	<1	P
<i>Calytrix tetragona</i>	3	25	2	1	P
<i>Carex breviculmis</i>	2	63	1	13	P
<i>Deyeuxia monticola</i>	1	38	1	5	P
<i>Epacris robusta</i>	2	25	0	0	P
<i>Kunzea ericoides</i>	3	75	2	4	P
<i>Kunzea muelleri</i>	3	75	2	<1	P
<i>Leptospermum micromyrtus</i>	2	88	1	<1	P
<i>Leptospermum namadgiensis</i>	2	25	0	0	P
<i>Leucopogon attenuatus</i>	2	38	1	1	P
<i>Oxylobium ellipticum</i>	2	38	1	4	P
<i>Pelargonium australe</i>	1	38	1	<1	P
<i>Poa induta</i>	2	38	3	6	P
<i>Prostanthera decussata</i>	2	25	2	<1	P
<i>Rytidosperma fulvum</i>	2	25	2	1	P
<i>Thelymitra</i> spp.	1	25	1	3	P



Plate g36: Community g36 is a shrubland of granite outcrops dominated by *Leptospermum micromyrtus* and *Kunzea muelleri*; This example is at Booroomba Rocks, Namadgi NP.

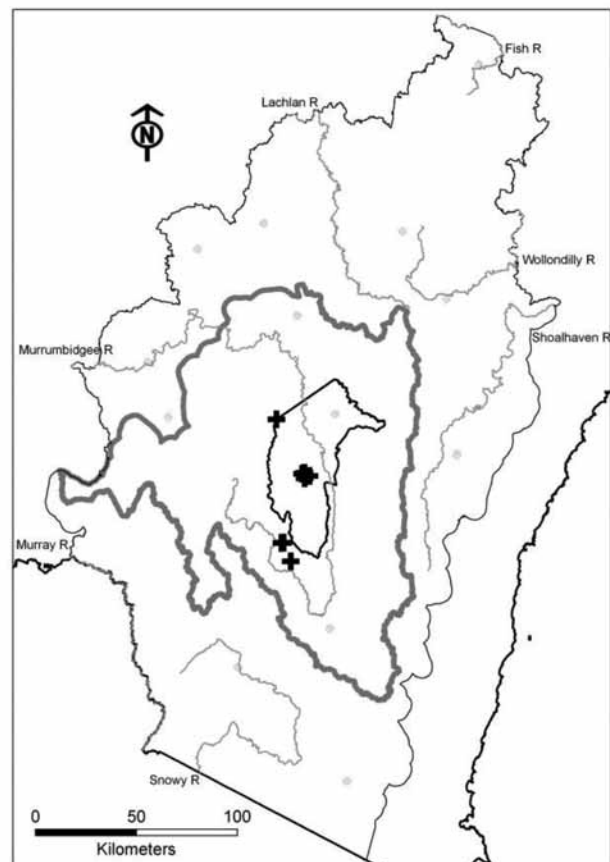


Fig. g36: Distribution of field samples assigned to this community

<i>Trachymene composita</i>	3	25	1	<1	P
<i>Veronica perfoliata</i>	1	38	1	4	P
<i>Gonocarpus tetragynus</i>	2	50	2	48	C

Threatened communities: Nil.

Equivalent vegetation types: Equivalent to Community VG36 [Montane / Sub-Alpine Dry Rocky Shrubland] (Gellie 2005).

Frequently occurring weeds: *Hypochaeris glabra*, *Hypochaeris radicata*, *Vulpia bromoides*, *Vulpia myuros* f. *megalura* (all 0.20).

Threats: Not considered to have any significant threats.

Reservation status: Likely to be entirely within conservation reserves; recorded from Namadgi NP, Brindabella NP and Yaouk NR.

Extent of clearing: Nil.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

Class: Alpine Bogs and Fens

a2: *Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)

Scientific Name: *Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* / *Carex gaudichaudiana* – *Sphagnum cristatum*

Number of samples:	38
Richness [mean (±SD)]:	20 (6)
Slope (degrees):	(0) 2–9 (20)
Altitude (m asl):	(1149) 1377–1741 (2004)
Ave. Annual Rainfall (mm):	(999) 1383–2051 (2488)
Temp. Annual Range (°C):	(20.3) 21.5–23.6 (24.8)

Vegetation Description: Community a2 generally occurs as a low closed wet heathland dominated by *Baeckea gunniana*, *Epacris paludosa* and *Richea continentis*, with intervening areas dominated by *Sphagnum cristatum* and associated herbs (e.g. *Astelia alpina*, *Astelia psychrocharis*, *Baloskion australe*, *Carex gaudichaudiana*, *Carpha nivicola*, *Celmisia* spp. (*Celmisia pugioniformis*, *Celmisia 'pulchella'* ms., *Celmisia tomentosa*), *Diplaspis nivis*, *Empodisma minus*, *Erigeron paludicola*, *Oreobolus distichus*, *Oschatzia cuneifolia* and *Poa costiniana*). At lower elevations this community is generally dominated by shrubs such as *Baeckea gunniana*, *Epacris paludosa*, *Richea continentis*, *Callistemon ptyoides* and *Epacris breviflora*, with *Epacris glacialis* becoming more frequent at higher elevations. It is found mainly in broad valleys, but also in seepage zones on slopes of low relief and along margins of smaller watercourses. Free water, either as pools or as slow-flowing streams is usually present.

This community is widespread from the Brindabella Ranges in the ACT through to Kosciuszko NP in NSW (and possibly extending into the South Eastern Highlands at lower altitudes). In Victoria it is known from The Cobberas and across the Bogong High Plains, with outlying examples on the Mt. Buffalo plateau. In the upper Murrumbidgee catchment, examples of this community are generally small, occurring in linear strips along creeks or as patches of less than 100 metres². Most are found in conservation reserves (Kosciuszko NP, Bimberi NR, Namadgi NP), with limited occurrences on State Forest and private land east of Tumberumba.

Characteristic Species:

Species	C/A	Freq	C/A O	Freq O	Fid
<i>Aciphylla simplicifolia</i>	1	29	1	2	P
<i>Asperula gunnii</i>	1	45	1	4	P
<i>Astelia psychrocharis</i>	1	32	1	<1	P
<i>Baeckea gunniana</i>	1	79	2	<1	P
<i>Baloskion australe</i>	1	55	1	1	P
<i>Brachyscome obovata</i>	1	39	1	<1	P
<i>Carex gaudichaudiana</i>	1	95	2	3	P
<i>Carpha nivicola</i>	1	29	1	<1	P
<i>Celmisia pugioniformis</i>	1	32	1	2	P
<i>Empodisma minus</i>	3	97	2	2	P
<i>Epacris glacialis</i>	2	26	1	<1	P
<i>Epacris gunnii</i>	1	24	1	2	P
<i>Epacris paludosa</i>	2	71	2	<1	P
<i>Erigeron gunnianum</i>	1	39	1	1	P
<i>Erigeron paludicola</i>	1	37	1	<1	P
<i>Gonocarpus micranthus</i>	1	29	1	2	P
<i>Hakea microcarpa</i>	1	21	1	3	P
<i>Luzula modesta</i>	1	53	1	2	P
<i>Oreobolus distichus</i>	1	50	1	<1	P
<i>Oreomyrrhis ciliata</i>	1	50	1	2	P
<i>Oschatzia cuneifolia</i>	1	24	1	<1	P
<i>Poa costiniana</i>	2	95	2	4	P
<i>Ranunculus pimpinellifolius</i>	1	24	1	1	P
<i>Richea continentis</i>	3	61	1	<1	P
<i>Rytidosperma nivicola</i>	1	24	1	<1	P
<i>Sphagnum cristatum</i>	4	89	2	<1	P

Threatened communities: TSC Act 1995 – *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions*; EPBC Act 1999 – *Alpine Sphagnum Bogs and Associated Fens*.

Equivalent vegetation types: *Epacris paludosa* – *Sphagnum cymbifolium* alliance and *Carex gaudichaudiana* – *Sphagnum cymbifolium* alliance and *Epacris breviflora* – *Blindia robusta* alliance (Costin 1954); *Sphagnum* – *Richea* – *Astelia* association (McVean 1969); types 4a and 4b (Helman & Gilmour 1985); groups 11 and 12 (Helman et al. 1988), combination of Community 2 [*Richea continentis* – *Carpha nivicola* – *Sphagnum cristatum* wet heathland] and Community 3 [*Baeckea gunniana* – *Callistemon ptyoides* – *Sphagnum cristatum* wet heathland] (McDougall & Walsh 2007).

Frequently occurring weeds: This community is generally low in weed diversity with the most common being *Trifolium repens* (0.07).

Threats: Historically this community was heavily degraded by cattle and sheep grazing, and by fire used for grazing management. Many examples were drained for water management during the Snowy Hydro Scheme and some were destroyed in early ski resort development. Damage still occurs as a result of trampling by feral horses, deer and pigs. Some freehold examples are still affected by domestic grazing practices.

Reservation status: Most examples of this community are in Kosciuszko NP and Namadgi NP. A few are in State Forest and freehold land adjoining Kosciuszko NP.

Extent of clearing: Not assessed. Very little has been cleared but all has been degraded.

References: Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); Helman, C.E. & Gilmour, P.M. (1985) Treeless vegetation above 1,000 metres altitude in the A.C.T. Unpublished report. Conservation Council of the Southeast Region and Canberra: Canberra; Helman, C.E., Gilmour, P.M., Osborne, W.S. & Green, K. (1988) An ecological survey of the upper Cotter catchment wilderness area, Namadgi National Park, ACT. Unpublished report. Conservation Council of the South-east Region and Canberra, Canberra; McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.



Plate a2: Community a2 (also known as bogs or peatlands) develops where drainage is impeded in the Australian Alps and surrounds. Examples may contain a range of tall or short shrubs but the moss and herbaceous layer is remarkably similar at most sites; this Richea continentis-dominated example near Mt Jagungal, Kosciuszko NP.

a7: *Ranunculus pimpinellifolius* – *Gonocarpus micranthus* herbfield of wetland margins in the Australian Alps bioregion

Scientific Name: *Ranunculus pimpinellifolius* – *Gonocarpus micranthus* – *Carex gaudichaudiana* – *Cotula alpina* – *Hydrocotyle algida* – *Montia australasica*

Number of samples:	2
Richness [mean (±SD)]:	20 (8)
Slope (degrees):	(2) 4–7 (9)
Altitude (m asl):	(1577) 1582–1591 (1595)
Ave. Annual Rainfall (mm):	(1775) 1817–1902 (1944)
Temp. Annual Range (°C):	(21.8) 21.9–22 (22)

Vegetation Description: Community a7 is a herbfield occurring in broad valleys or around seepage zones on flat ground anywhere in the subalpine zone where soils are relatively deep and permanently sodden (but not inundated); often found on sites with basaltic parent material. Forbs such as *Hypericum japonicum*, *Ranunculus pimpinellifolius*, *Gonocarpus micranthus*, *Nertera granadensis* and *Epilobium curtisiae* are the usual dominants and form a dense mat of overlapping foliage.

Examples of this community are often small (a few metres²) and adjoin Community a2 [*Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)]. It has been recorded from Boggy Plain near Tantangara, Long Plain and Bogong Plain near Mt. Jagungal (all in the upper Murrumbidgee catchment) but undoubtedly commonly occurs elsewhere within the subalpine area and possibly into the ACT. It is also found in the Victorian high country.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O	Fid
<i>Agrostis venusta</i>	1	50	1	<1		P
<i>Baeckea gunniana</i>	1	50	2	1		P
<i>Brachycome tadgellii</i>	1	50	1	<1		P
<i>Carex cephalotes</i>	1	50	1	<1		P
<i>Carex echinata</i>	1	50	1	<1		P
<i>Carex gaudichaudiana</i>	3	100	2	4		P
<i>Cotula alpina</i>	2	100	1	1		P
<i>Epilobium curtisiae</i>	1	50	1	<1		P
<i>Epilobium gunnianum</i>	1	100	1	1		P
<i>Gonocarpus micranthus</i>	2	100	1	2		P
<i>Hydrocotyle algida</i>	2	100	1	1		P
<i>Isolepis subtilissima</i>	2	50	1	<1		P
<i>Juncus falcatus</i>	2	50	1	<1		P
<i>Luzula modesta</i>	1	50	1	2		P
<i>Montia australasica</i>	2	100	1	1		P
<i>Myriophyllum alpinum</i>	2	50	1	<1		P
<i>Myriophyllum pedunculatum</i>	1	50	1	<1		P
<i>Nertera granadensis</i>	1	50	1	<1		P
<i>Olearia algida</i>	1	50	1	<1		P
<i>Oreobolus pumilio</i>	1	50	2	<1		P
<i>Oreomyrrhis ciliata</i>	2	100	1	2		P
<i>Poa costiniana</i>	1	100	2	5		P
<i>Ranunculus millanii</i>	1	100	1	<1		P
<i>Ranunculus pimpinellifolius</i>	3	100	1	1		P
<i>Richea continentis</i>	1	50	2	<1		P
<i>Rytidosperma nivicola</i>	1	50	1	<1		P
<i>Acaena echinata</i>	1	50	1	9		C
<i>Hypericum japonicum</i>	1	50	1	4		C

Threatened communities: TSC Act 1995 – *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions.*

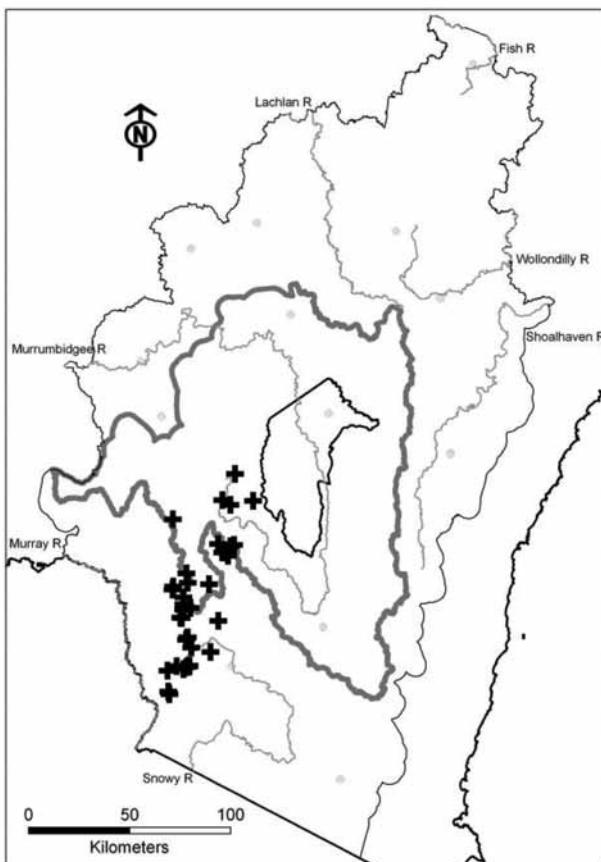


Fig. a2: Distribution of field samples assigned to this community.



Plate a7: Community a7 is typically very small in extent, being found at the margins of various wetlands; this example at Long Plain in Kosciuszko NP.

Equivalent vegetation types: Community 7 [*Hypericum japonicum* – *Ranunculus pimpinellifolius herbfield*] (McDougall & Walsh 2007).

Frequently occurring weeds: *Taraxacum officinale* (0.5), *Trifolium repens* (0.5).

Threats: A relatively high weed cover in plots (particularly *Acetosella vulgaris*, *Cerastium glomeratum*, *Holcus lanatus* and *Trifolium repens*) is indicative of past disturbance. Sites in NSW may be affected by pigs and are especially vulnerable to trampling by feral horses.

Reservation status: Possibly all within Kosciuszko NP.

Extent of clearing: Nil, but probably severely damaged by trampling when grazed by domestic stock.

Reference: McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

a8: *Carex gaudichaudiana* – *Myriophyllum pedunculatum* – *Deschampsia cespitosa* sedgeland of the Australian Alps bioregion (Fen)

Scientific Name: *Carex gaudichaudiana* – *Myriophyllum pedunculatum* – *Deschampsia cespitosa* – *Isolepis montivaga*

Number of samples:	7
Richness [mean (±SD)]:	12 (6)
Slope (degrees):	(1) 2–4 (13)
Altitude (m asl):	(1281) 1559–1760 (1920)
Ave. Annual Rainfall (mm):	(1525) 1758–2040 (2405)
Temp. Annual Range (°C):	(20.7) 21.4–21.9 (23.5)

Vegetation Description: Community a8 is a wet sedgeland (fen) dominated by the sedge *Carex gaudichaudiana*, making it one of the most immediately recognisable of alpine/subalpine communities. Typically, sites are inundated through most (if not all) summer with water depths up to approximately 15 centimetres. Examples tend to be species-poor but in some areas *Brachyscome obovata*, *Carex echinata*, *Deschampsia cespitosa*, *Epilobium gunnianum*, *Isolepis montivaga* and *Myriophyllum pedunculatum* are reasonably common. *Sphagnum cristatum* often occupies any ground raised slightly above the bed of the fen. *Poa costiniana* is a frequent component of this community but is typically present only at the margins of the zone of permanent inundation. This community is highly variable and poorly sampled.

This community is widespread in valleys and low saddles in Kosciuszko NP (extending into the alpine zone) and subalpine valleys of the ACT. It is known from Victoria where it is far less common. Examples in the upper Murrumbidgee catchment are often small and form part of a mosaic with Community a2 [*Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)] in areas of impeded drainage, and Community a14 [*Poa constiniana* – *Carex gaudichaudiana* subalpine valley grassland of the Australian Alps bioregion].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Asperula gunnii</i>	1	43	1	5			P
<i>Baloskion australe</i>	1	43	1	2			P
<i>Brachyscome obovata</i>	1	43	1	1			P
<i>Cardamine astoniae</i>	2	29	1	<1			P
<i>Carex echinata</i>	2	29	1	<1			P
<i>Carex gaudichaudiana</i>	4	100	2	4			P
<i>Carpha nivicola</i>	1	29	1	<1			P
<i>Deschampsia cespitosa</i>	1	57	1	<1			P
<i>Epilobium gunnianum</i>	1	43	1	1			P
<i>Isolepis montivaga</i>	1	29	1	<1			P

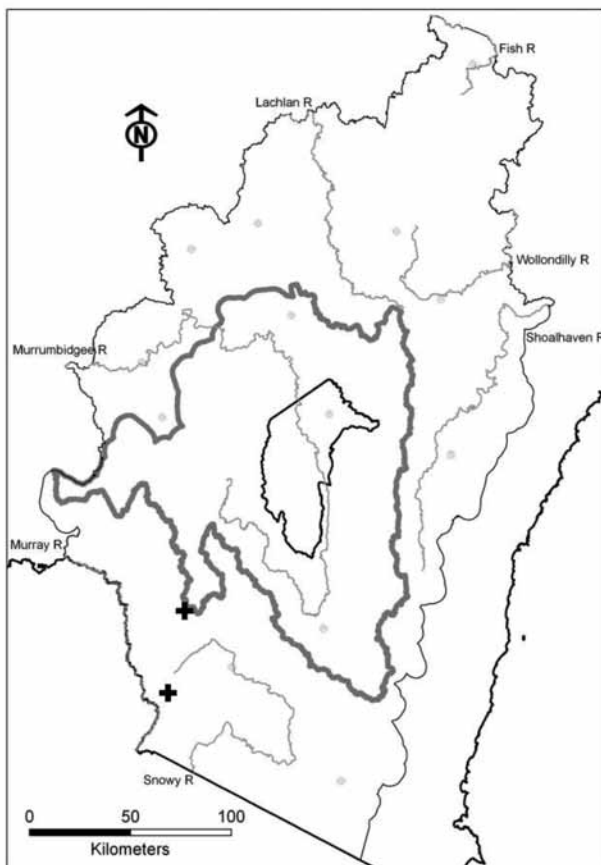


Fig. a7: Distribution of field samples assigned to this community.

<i>Juncus falcatus</i>	1	29	2	<1	P
<i>Luzula modesta</i>	1	29	1	2	P
<i>Montia australasica</i>	1	29	1	1	P
<i>Myriophyllum pedunculatum</i>	1	57	1	<1	P
<i>Oreomyrrhis ciliata</i>	2	29	1	2	P
<i>Poa costiniana</i>	1	71	2	5	P
<i>Ranunculus pimpinellifolius</i>	2	29	1	1	P
<i>Richea continentis</i>	1	29	2	<1	P
<i>Sphagnum cristatum</i>	2	57	3	1	P

Threatened communities: TSC Act 1995 – *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions*; EPBC Act 1999 – *Alpine Sphagnum Bogs and Associated Fens*.

Equivalent vegetation types: *Carex gaudichaudiana* alliance (Costin 1954); *Carex – Drepanocladus* association (McVean 1969); Vegetation Type 6a (Helman & Gilmour 1985); Fen (Costin *et al.* 2000); Community 8 [*Fen*] (McDougall & Walsh 2007).

Frequently occurring weeds: No weeds have been recorded in plots in this community.

Threats: The weed *Myosotis caespitosa*, although not recorded in plots, is abundant at a few sites in Kosciuszko NP (e.g. Boggy Plain, Ogilvies Plain) and may threaten the integrity of this community.

Reservation status: Possibly all within Kosciuszko and Namadgi NPs.

Extent of clearing: Nil, but this community was probably highly degraded by domestic grazing. The dominant species, *Carex gaudichaudiana*, is noted for its high palatability (Van Rees & Holmes 1986).

References: Costin, A.B. (1954) A study of the ecosystems of the Monaro region of New South Wales. (Government Printer: Sydney); Costin, A.B Helman, C.E. & Gilmour, P.M. (1985) Treeless vegetation above 1,000 metres altitude in the A.C.T. Unpublished report. Conservation Council of the Southeast Region and Canberra: Canberra; McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57; McVean, D.N. (1969) Alpine vegetation of the central Snowy Mountains of New South Wales. *Journal of Ecology* 57: 67–86; Van Rees, H. & Holmes, J.H.G. (1986) The botanical composition of the diet of free-ranging cattle on an alpine range in Australia. *Journal of Range Management* 39: 392–395.



Plate a8: Subalpine and alpine areas where water lies for long periods are usually dominated by *Carex gaudichaudiana*. They are commonly known as fens. Species richness is a function of the duration of inundation.

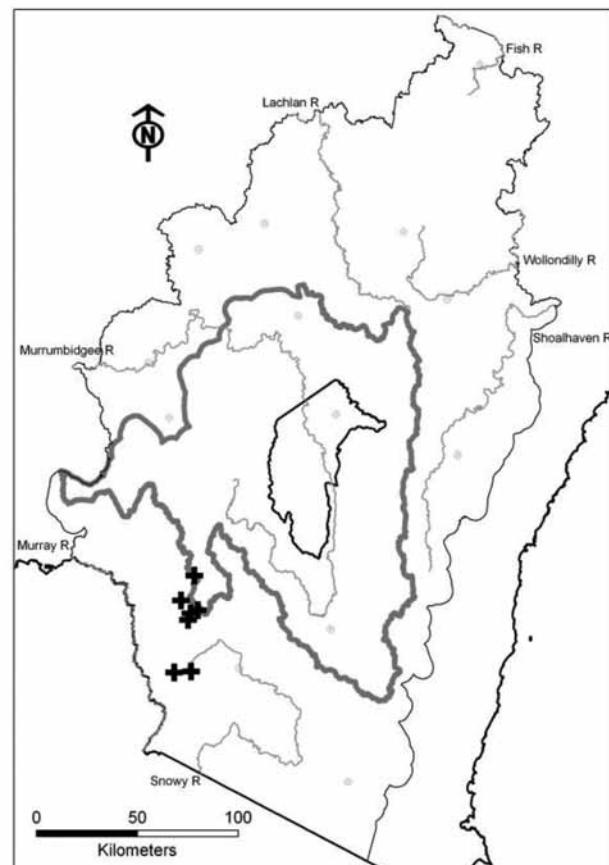


Fig. a8: Distribution of field samples assigned to this community.

Formation: Rainforests**Class: Cool Temperate Rainforests****g172: Black Sassafras temperate rainforest of wet sheltered slopes in the Australian Alps and Bondo subregion of the South Eastern Highlands bioregions**

Scientific Name: *Atherosperma moschatum* – *Dicksonia antarctica* / *Polystichum proliferum* – *Blechnum fluviatile* – *Australina pusilla* – *Asplenium flabellifolium*

Number of samples:	2
Richness [mean (±SD)]:	14 (3)
Slope (degrees):	(8) 10–13 (14)
Altitude (m asl):	(1037) 1053–1084 (1099)
Ave. Annual Rainfall (mm):	(1104) 1126–1170 (1192)
Temp. Annual Range (°C):	(25) 25.1–25.2 (25.2)

Vegetation Description: Community g172 is a rare rainforest community to about 20 metres high, dominated by *Atherosperma moschatum*. The shrub layer is dominated by *Dicksonia antarctica*, with a sparse groundlayer dominated by *Polystichum proliferum*, *Blechnum fluviatile*, *Australina pusilla*, *Asplenium flabellifolium*, *Urtica incisa* and *Viola hederacea*.

This community occurs in deep east facing valleys and gorges, mainly as a narrow band along drainage lines usually only a few metres wide and often overtopped by the canopy of adjacent Community u40 [*Alpine Ash tall wet sclerophyll open forest primarily of the Australian Alps bioregion*], and occasionally, u52 [*Ribbon Gum – Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo subregion of the South Eastern Highlands and the northern Australian Alps bioregions*]. However, the structure and floristics of these communities are distinct and they do not intergrade.

Community g172 is found as isolated patches along creeks near Bogong Peaks (such as Stinking Creek and the upper Goobaragandra River), the Geehi Valley (Greening Australia 2011), and the Jacobs and Pinch River Gorges. While it is sampled only at higher elevations in the Murray catchment, within the study area it is found down to 700 metres above sea level, some 150 metres below the occurrence of *Eucalyptus delegatensis*. Stands in the Pinch River Gorge contain *Elaeocarpus holopetalus* (Doherty et al. 2011). A similar community also occurs in southern parts of Tallaganda SF east of the divide, and possibly in Gourrock NP, although further sampling is required to quantify their relationship (J. Crooks, DPI, pers. comm.).

Fire is believed to have limited the extent of this community, as it is only found in locations that are protected from wildfires, which in the Australian Alps and Bondo subregion of the South Eastern Highlands are usually driven by strong north-westerly winds. Remnant stands do not seem to be burnt even in extreme events such as the 2003 wildfires that affected 70% of Kosciuszko NP.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Asplenium bulbiferum</i> subsp. <i>gracillimum</i>	1	50	2	<1			P
<i>Asplenium flabellifolium</i>	2	100	1	9			P
<i>Atherosperma moschatum</i>	6	100	3	<1			P
<i>Australina pusilla</i>	2	100	2	1			P
<i>Blechnum fluviatile</i>	2	100	0	0			P
<i>Dicksonia antarctica</i>	4	100	3	2			P
<i>Diplazium australe</i>	2	50	2	<1			P
<i>Histiopteris incisa</i>	1	50	1	<1			P
<i>Leptospermum grandifolium</i>	1	50	3	2			P
<i>Polystichum proliferum</i>	2	100	1	7			P
<i>Sambucus australasica</i>	2	50	2	<1			P
<i>Sambucus gaudichaudiana</i>	2	50	1	<1			P
<i>Tasmannia xerophila</i>	1	50	1	2			P
<i>Urtica incisa</i>	1	100	1	2			P
<i>Veronica subtilis</i>	1	50	1	<1			P
<i>Viola hederacea</i>	1	100	2	19			P
<i>Eucalyptus delegatensis</i>	1	50	3	5			C
<i>Poa helmsii</i>	1	50	2	4			C
<i>Rubus parvifolius</i>	1	50	1	11			C
<i>Tasmannia lanceolata</i>	1	50	1	4			C

Threatened communities: Nil, but given its highly restricted distribution and the potential for wildfires to effect this community, it is possibly eligible for listing.

Equivalent vegetation types: This community was identified by Gellie (2005) as Community VG172 [*Kosciuszko Western Escarpment Cool Temperate Rainforest*].

Frequently occurring weeds: No weeds were recorded within plot samples.

Threats: Climate change and an increased incidence of hot fires may reduce the extent of the community.

Reservation status: Within the Upper Murrumbidgee catchment all sites known are in Kosciuszko NP.

Extent of clearing: Nil.

References: Doherty, M.D., Robertson, G., Corcoran, D. & Wright, G. (2011) Cool temperate rainforest in the Pilot wilderness area, Kosciuszko National Park: distribution, composition and impact of the 2003 fires. *Cunninghamia* 12: 119–127; Greening Australia (2011) Survey of southern sassafras (*Atherosperma moschatum*) in the Murphies Swamp area, Bogong Peak wilderness, Kosciuszko National Park. A report by Greening Australia capital region for the NSW Department of Environment, Climate Change and Water. Unpublished. February 2011; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate g172: Beneath the canopy of community g172, with *Dicksonia antarctica* beneath *Atherosperma moschatum*. 2.4 km east of Tin Mine Hut, Pilot Wilderness, Kosciuszko NP.

Formation: Wet Sclerophyll Forests

Class: Montane Wet Sclerophyll Forests

u40: Alpine Ash very tall wet sclerophyll open forest primarily of the Australian Alps bioregion

Scientific Name: *Eucalyptus delegatensis* ± *Eucalyptus dalrympleana* / *Polyscias sambucifolia* subsp. *leptophylla* – *Coprosma hirtella* – *Veronica derwentiana* / *Poa helmsii* – *Stellaria pungens* – *Polystichum proliferum*

Number of samples:	35
Richness [mean (±SD)]:	27 (7)
Slope (degrees):	(1) 16–26 (35)
Altitude (m asl):	(1021) 1163–1337 (1504)
Ave. Annual Rainfall (mm):	(1042) 1261–1533 (1802)
Temp. Annual Range (°C):	(22.1) 23.2–24.6 (25.2)

Vegetation Description: Community u40 is a very tall open forest dominated by *Eucalyptus delegatensis*, often with *Eucalyptus dalrympleana* occurring at low abundance. At maturity, this community ranges from 25m to 45m in height. The understorey is predominantly shrubby and of variable density depending on site condition and time since fire. It is typically dominated by *Polyscias sambucifolia* subsp. *leptophylla*, *Tasmannia xerophila* and *Coprosma hirtella*. *Daviesia latifolia* and *Acacia obliquinervia* occur in many sites in abundance after fire. *Polystichum proliferum*, *Veronica derwentiana*, *Dianella tasmanica*, *Stellaria pungens*, *Viola betonicifolia* and *Poa helmsii* are frequently occurring groundlayer taxa.

This community is found mainly from Cabramurra to The Pilot on the western side of the Kosciuszko Range, mostly on steep slopes. In the ACT, it is found in Namadgi NP at Bulls Head and above Smokers Gap. At higher altitudes the community may grade into Community u158 [*Alpine Sallee shrub-grass subalpine mid-high woodland of the Australian Alps bioregion*], and at lower elevations it may grade into Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*].

Eucalyptus delegatensis is killed by crown fires. Recruitment after hot fires is often prolific, with very high stand densities. Following a crown fire the vegetation is often dominated by shrubs of the genera *Daviesia* and *Acacia* for several years until trees grow sufficiently to exert site dominance. The vegetation is often extremely dense, with many thousands of tree stems per hectare. If fires occur at intervals of 20 years or less, young *Eucalyptus delegatensis* are unlikely to have flowered and developed seed. In these circumstances the vegetation may become a shrubland with scattered trees of *Eucalyptus dalrympleana* or *Eucalyptus pauciflora* subsp. *pauciflora*, which usually resprout after fire (G. Robertson, OEH, pers. comm.), presenting a succession to Community u53 [*Mountain Gum – Blackwood tall wet sclerophyll open forest primarily on granitoids of the Australian Alps and western South Eastern Highlands bioregions*] or Community u239 [*Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions*].

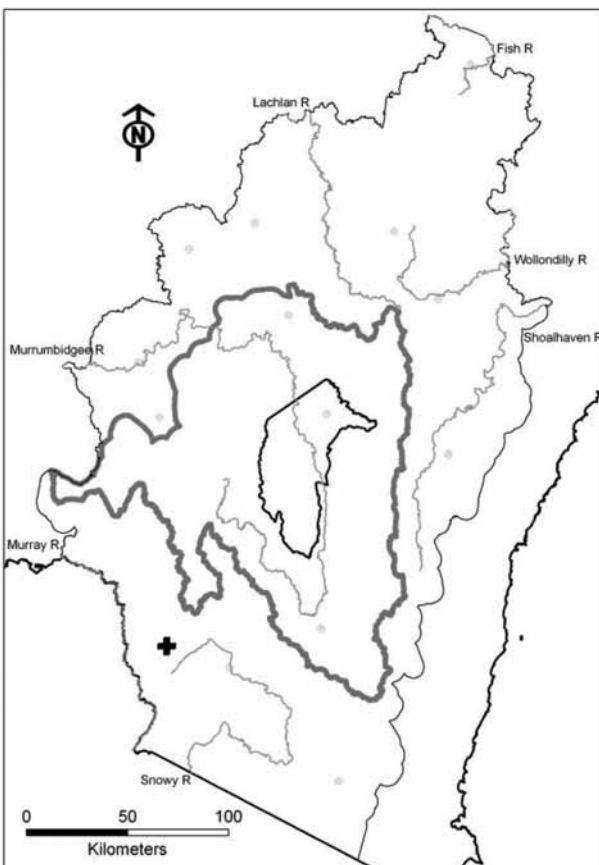


Fig. g172: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia obliquinervia</i>	2	37	1	3			P
<i>Acaena novae-zelandiae</i>	1	51	1	27			P
<i>Asperula euryphylla</i>	2	29	1	<1			P
<i>Bossiaea foliosa</i>	2	29	2	4			P
<i>Cassinia aculeata</i>	2	46	1	14			P
<i>Coprosma hirtella</i>	2	86	1	11			P
<i>Daviesia latifolia</i>	4	57	2	7			P
<i>Dianella tasmanica</i>	2	71	1	16			P
<i>Eucalyptus dalrympleana</i>	1	46	3	20			P
<i>Eucalyptus delegatensis</i>	3	91	3	4			P
<i>Galium polyanthum</i>	2	23	1	2			P
<i>Leucopogon gelidus</i>	1	26	1	2			P
<i>Olearia megalophylla</i>	2	31	1	4			P
<i>Olearia phlogopappa</i>	1	54	1	2			P
<i>Ozothamnus secundiflorus</i>	1	37	1	<1			P
<i>Picris angustifolia</i>	1	20	1	2			P
<i>Poa ensiformis</i>	3	23	2	2			P
<i>Poa helmsii</i>	3	80	1	3			P
<i>Polyscias sambucifolia</i> subsp. <i>leptophylla</i>	2	89	1	4			P
<i>Polystichum proliferum</i>	2	80	1	7			P
<i>Prostanthera lasianthos</i>	1	31	1	1			P
<i>Rubus parvifolius</i>	2	71	1	11			P
<i>Senecio pinnatifolius</i> var. <i>lanceolatus</i>	2	37	2	<1			P
<i>Stellaria pungens</i>	2	83	2	31			P
<i>Tasmania xerophila</i>	2	57	1	1			P
<i>Veronica derwentiana</i>	2	80	1	6			P
<i>Viola betonicifolia</i>	2	71	1	27			P
<i>Viola hederacea</i>	1	40	2	18			P
<i>Clematis aristata</i>	1	43	1	24			C

Threatened communities: Nil

Equivalent vegetation types: This community is defined by a large group of field survey plots, some of which (10) were also classified by Gellie (2005). Most of these were assigned to Community VG87 [Western Escarpment Moist Shrub/Herb/Grass Forest], with a smaller number classified as Community VG86 [Western Sub-alpine Moist Shrub Forest].

Frequently occurring weeds: The distribution of this community on public land is the primary reason for the low abundance of weed species within it. Disturbances most likely to allow weed invasion include logging (in State Forests), road construction and maintenance, and high intensity fire. *Cirsium vulgare* (0.17) was the most commonly recorded weed species from within this community.

Threats: Hot fires at intervals of less than 20 years are likely to eliminate the key canopy species, *Eucalyptus delegatensis*.

Reservation status: There are around 100,000 hectares of *Eucalyptus delegatensis* (all community types) in NSW, with about 80,000 hectares reserved in Kosciuszko NP and Brindabella NP (G. Robertson, OEH, pers. comm.). Most of the area not reserved occurs in Bago, Maragle and Ingebyra SFs..

Extent of clearing: This community has not been affected by clearing, although it is the subject of regenerative logging in State Forest tenure.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate u40: A burnt example of community u40, with a regenerating *Daviesia latifolia* understorey on the Alpine Way between Tom Groggin and Dead Horse Gap, Kosciuszko NP.

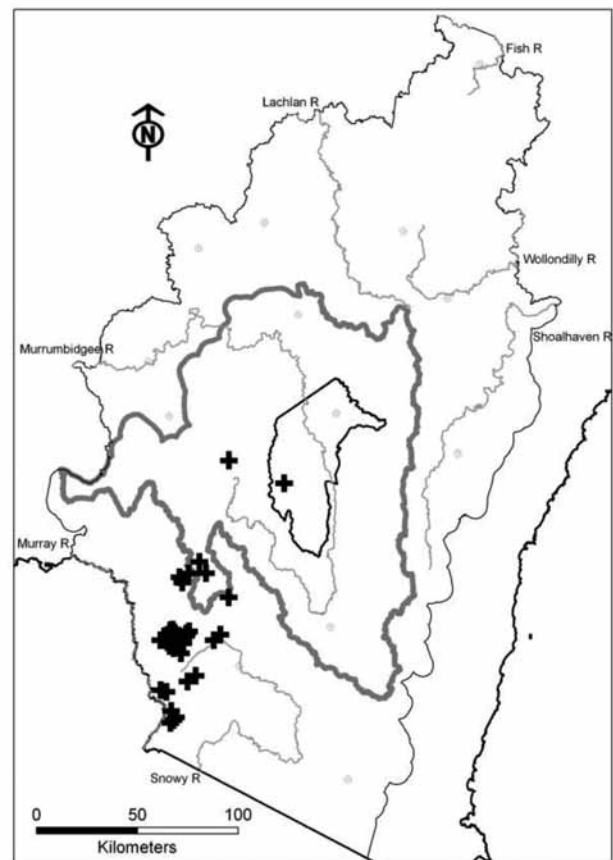


Fig. u40: Distribution of field samples assigned to this community.

u53: Mountain Gum – Blackwood tall wet sclerophyll open forest primarily on granitoids of the Australian Alps and western South Eastern Highlands bioregions

Scientific Name: *Eucalyptus dalrympleana* ± *Eucalyptus delegatensis* – *Eucalyptus viminalis* – *Eucalyptus pauciflora* subsp. *pauciflora* / *Acacia melanoxylon* / *Leptospermum grandifolium* – *Epacris breviflora* – *Tasmannia lanceolata* / *Polystichum proliferum* – *Acaena novae-zelandiae* – *Blechnum nudum*

Number of samples:	18
Richness [mean (±SD)]:	34 (12)
Slope (degrees):	(1) 8–18 (26)
Altitude (m asl):	(924) 1101–1261 (1368)
Ave. Annual Rainfall (mm):	(895) 1020–1385 (1506)
Temp. Annual Range (°C):	(23.3) 23.9–25.3 (25.7)

Vegetation Description: Community u53 is a tall to very tall open forest dominated by *Eucalyptus dalrympleana*. The well developed midstorey is characterised by the tall shrub *Acacia melanoxylon* along with smaller shrubs such as *Leptospermum grandifolium*, *Coprosma hirtella*, *Tasmannia lanceolata*, *Coprosma quadrifida*, *Baeckea utilis* and *Lomatia myricoides*. The moist groundlayer is a diverse mix of ferns, forbs and grasses, including *Acaena novae-zelandiae*, *Polystichum proliferum*, *Blechnum nudum*, *Carex appressa*, *Poa helmsii*, *Blechnum penna-marina* subsp. *alpina*, *Clematis aristata*, *Mentha laxiflora*, *Lagenophora stipitata*, *Stellaria pungens*, *Pteridium esculentum*, *Viola hederacea* and *Asperula scoparia*.

This community is most common within northern parts of the Australian Alps bioregion, and adjacent high altitude regions of the western South Eastern Highlands bioregion. It is found through Namadgi NP, northern Kosciuszko NP and Bago SF. It occurs on a variety of aspects, but favours sheltered locations – most often adjacent to drainage features. It is most common on granite, granodiorite or metasedimentary geologies. Co-occurring communities include Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*] and Community u239 [*Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions*] which generally occupies more exposed locations. Narrow creeklines within Community u53 may be dominated by dense patches of *Leptospermum grandifolium*, a shrub of up to 4 metres in height.

Characteristic Species:

Species	C/A	Freq	C/A	Freq	O	Fid
<i>Acacia melanoxylon</i>	2	67	1	14		P
<i>Acaena novae-zelandiae</i>	2	72	1	27		P
<i>Baeckea utilis</i>	2	44	2	1		P
<i>Blechnum minus</i>	2	39	1	<1		P
<i>Blechnum nudum</i>	3	67	2	3		P
<i>Blechnum penna-marina</i> subsp. <i>alpina</i>	2	61	1	<1		P
<i>Blechnum wattsii</i>	2	28	2	<1		P
<i>Carex appressa</i>	2	67	1	7		P
<i>Clematis aristata</i>	1	61	1	24		P
<i>Coprosma hirtella</i>	1	72	1	11		P
<i>Coprosma quadrifida</i>	1	50	1	8		P
<i>Deyeuxia brachyathera</i>	1	28	1	<1		P
<i>Epacris breviflora</i>	2	83	1	2		P
<i>Epilobium billardierianum</i> subsp. <i>hydrophilum</i>	2	44	1	<1		P
<i>Eucalyptus dalrympleana</i>	2	61	3	20		P
<i>Eucalyptus delegatensis</i>	3	39	3	5		P
<i>Eucalyptus viminalis</i>	3	39	3	13		P

<i>Gonocarpus micranthus</i>	1	22	1	2		P
<i>Gratiola peruviana</i>	2	22	1	1		P
<i>Isolepis subtilissima</i>	1	33	1	<1		P
<i>Lagenophora stipitata</i>	2	56	1	17		P
<i>Leptinella filicula</i>	1	28	1	3		P
<i>Leptospermum grandifolium</i>	3	100	2	1		P
<i>Lomatia myricoides</i>	2	44	1	11		P
<i>Mentha laxiflora</i>	2	61	2	<1		P
<i>Olearia phlogopappa</i>	2	33	1	3		P
<i>Poa helmsii</i>	2	67	2	3		P
<i>Polyscias sambucifolia</i> subsp. <i>leptophylla</i>	1	28	2	4		P
<i>Polystichum proliferum</i>	2	72	1	7		P
<i>Prostanthera lasianthos</i>	3	22	1	1		P
<i>Ranunculus lappaceus</i>	1	39	1	11		P
<i>Rubus parvifolius</i>	2	56	1	11		P
<i>Senecio biserratus</i>	1	22	1	<1		P
<i>Senecio hispidulus</i>	2	22	1	2		P
<i>Tasmannia lanceolata</i>	2	72	1	3		P
<i>Veronica derwentiana</i>	1	39	1	7		P
<i>Pteridium esculentum</i>	1	44	2	27		C
<i>Stellaria pungens</i>	1	50	2	31		C
<i>Viola hederacea</i>	1	44	2	18		C

Threatened communities: Nil.

Equivalent vegetation types: This community is most closely related to Community VG86 [*Western Sub-alpine Moist Shrub Forest*] described by Gellie (2005). Patches where *Leptospermum grandifolium* is dominant may represent VG84 [*Montane Wet Heath/Herb Woodland*] of Gellie (2005) but this wasn't identified as a distinct community in the current study, possibly because of undersampling. A *Leptospermum grandifolium* shrubland occurs in similar vegetation and landscape positions in the Victorian high country.

Frequently occurring weeds: The weeds most frequently recorded in this community are typical of those recorded in other wet forest communities of the region, and include *Cirsium vulgare* (0.22), *Hypochaeris radicata* (0.28) and *Prunella vulgaris* (0.33).

Threats: Where this community occurs in State Forest or on private land, impacts associated with logging are a potential threat to the overstorey and structure of the understorey. Grazing by feral herbivores may also impact upon this community, especially where it occurs within drainage features or adjacent to open woodland communities. As with all vegetation in extensively forested regions, frequent and intense fire represents a major threat to the distribution and composition of this community.

Reservation status: Recorded from survey plots within Kosciuszko NP and Namadgi NP; likely to be well reserved.

Extent of clearing: Considered minimal.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate u53: Community u53 dominated by tall *Eucalyptus dalrympleana* with a shrubby herbaceous understorey. Murray’s Gap Trail, Namadgi NP.

u239: Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions

Scientific Name: *Eucalyptus delegatensis* – *Eucalyptus dalrympleana* ± *Eucalyptus pauciflora* subsp. *pauciflora* / *Coprosma hirtella* – *Lomatia myricoides* – *Olearia megalophylla* / *Asperula scoparia* – *Clematis aristata* – *Stellaria pungens* – *Viola betonicifolia*

Number of samples:	100
Richness [mean (±SD)]:	29 (7)
Slope (degrees):	(1) 8–18 (36)
Altitude (m asl):	(1006) 1179–1357 (1526)
Ave. Annual Rainfall (mm):	(846) 1101–1365 (1653)
Temp. Annual Range (°C):	(22.2) 23.5–24.5 (25.3)

Vegetation Description: Community u239 is a tall to very tall open forest dominated by *Eucalyptus delegatensis* and *Eucalyptus dalrympleana*. *Eucalyptus pauciflora* subsp. *pauciflora* is often present. The higher abundance of *Eucalyptus dalrympleana* and the presence of *Eucalyptus pauciflora* subsp. *pauciflora* and other species of drier sites indicate that this community occurs in drier habitats than Community u40 [Alpine Ash tall wet sclerophyll open forest primarily of the Australian Alps bioregion]. At maturity, this community ranges from 25m to 45m in height. Below the canopy it is often variable and may be grassy or shrubby, depending on site condition and fire history. The shrub layer is often a sparse cover of *Coprosma hirtella*, *Acacia dealbata*, *Daviesia mimosoides* and *Lomatia myricoides*. The groundlayer is a mixture of grasses, forbs and climbers (e.g. *Poa sieberiana*, *Poa phillipsiana*, *Asperula scoparia*, *Stellaria pungens*, *Clematis aristata*, *Coronidium scorpioides* and *Viola betonicifolia*).

This community is found mainly from the Brindabella Range south to the Victorian border, but is more common north of Khancoban, mostly on steep slopes between 1,000 and 1,400 metres above sea level. In the Australian Alps bioregion it often grades into Community u158 [Alpine Sallee shrub-grass subalpine mid-high woodland of the Australian Alps bioregion], and at lower elevations this community grades into Community u22 [Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions]. In moister sheltered slopes at the southern edge of its range this community may grade into Community u40 [Alpine Ash tall wet sclerophyll open forest primarily of the Australian Alps bioregion].

For information on the fire ecology of *Eucalyptus delegatensis* dominated communities, refer to the description of Community u40.

Characteristic Species:

Species	C/A	Freq	C/A	O/Freq	O/Fid
<i>Acacia dealbata</i>	2	51	2	25	P
<i>Acacia kettlewelliae</i>	2	5	1	<1	P
<i>Acacia obliquinervia</i>	2	23	1	2	P
<i>Acaena novae-zelandiae</i>	1	45	1	27	P
<i>Arthropodium milleflorum</i>	1	34	1	7	P
<i>Asperula scoparia</i>	2	85	2	20	P
<i>Billardiera macrantha</i>	1	6	1	<1	P
<i>Brachyscome spathulata</i>	2	38	1	10	P
<i>Caladenia alpina</i>	1	5	1	<1	P
<i>Cassinia aculeata</i>	1	39	1	13	P
<i>Chiloglottis pluricallata</i>	1	7	1	<1	P
<i>Chiloglottis valida</i>	1	14	1	2	P
<i>Clematis aristata</i>	2	78	1	22	P
<i>Coprosma hirtella</i>	2	85	1	9	P
<i>Coronidium scorpioides</i>	2	49	1	19	P
<i>Craspedia jamesii</i>	1	20	1	3	P

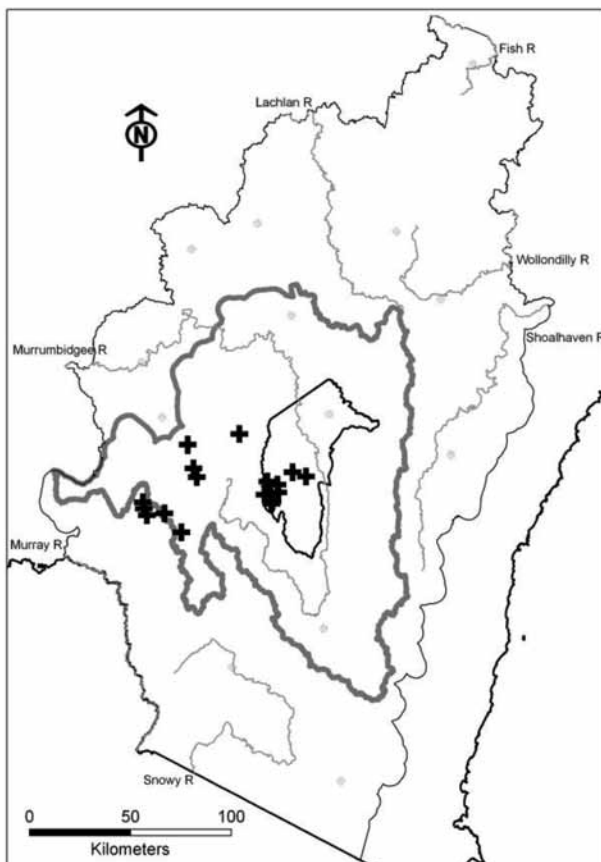


Fig. u53: Distribution of field samples assigned to this community.

<i>Craspedia</i> spp.	2	19	1	3	P
<i>Daviesia latifolia</i>	3	26	2	6	P
<i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>	3	36	2	9	P
<i>Daviesia ulicifolia</i>	2	32	1	9	P
<i>Deyeuxia monticola</i>	1	22	1	5	P
<i>Deyeuxia rodwayi</i>	1	5	1	1	P
<i>Dianella tasmanica</i>	1	48	1	15	P
<i>Eucalyptus dalrympleana</i>	2	77	3	18	P
<i>Eucalyptus delegatensis</i>	4	96	3	2	P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	2	50	3	20	P
<i>Geranium potentilloides</i>	1	43	1	12	P
<i>Gonocarpus montanus</i>	1	8	1	1	P
<i>Lagenophora stipitata</i>	1	40	1	17	P
<i>Leptinella filicula</i>	1	17	1	3	P
<i>Leucopogon gelidus</i>	1	15	1	2	P
<i>Lobelia pedunculata</i>	1	18	1	5	P
<i>Lobelia puberula</i>	1	11	1	<1	P
<i>Lomatia myricoides</i>	2	46	1	11	P
<i>Olearia erubescens</i>	1	45	1	11	P
<i>Olearia megalophylla</i>	1	45	1	4	P
<i>Olearia phlogopappa</i>	1	16	1	3	P
<i>Oxylobium ellipticum</i>	2	11	1	4	P
<i>Ozothamnus stirlingii</i>	2	9	1	<1	P
<i>Ozothamnus thyrsoideus</i>	1	8	1	2	P
<i>Persoonia chamaepeuce</i>	1	22	1	11	P
<i>Persoonia subvelutina</i>	2	20	1	<1	P
<i>Picris angustifolia</i>	1	10	1	2	P
<i>Picris angustifolia</i> subsp. <i>angustifolia</i>	2	7	1	2	P
<i>Platylobium montanum</i>	2	29	2	10	P
<i>Poa helmsii</i>	1	13	2	3	P
<i>Poa induta</i>	2	14	3	6	P
<i>Poa phillipsiana</i>	4	26	2	2	P
<i>Podolobium alpestre</i>	1	9	2	2	P
<i>Polyscias sambucifolia</i> subsp. <i>leptophylla</i>	2	36	2	3	P
<i>Polystichum proliferum</i>	1	19	1	7	P
<i>Poranthera microphylla</i>	1	60	1	26	P
<i>Pterostylis monticola</i>	1	7	1	<1	P
<i>Ranunculus plebeius</i>	1	14	1	3	P
<i>Ranunculus scapiger</i>	1	11	1	1	P
<i>Ranunculus</i> spp.	1	8	1	2	P
<i>Senecio diaschides</i>	1	15	1	5	P
<i>Senecio gunnii</i>	1	44	1	8	P
<i>Senecio linearifolius</i>	1	13	1	5	P
<i>Stackhousia monogyna</i>	1	23	1	12	P
<i>Stellaria pungens</i>	2	78	2	30	P
<i>Tasmannia lanceolata</i>	1	27	1	3	P
<i>Veronica derwentiana</i>	1	46	1	6	P
<i>Viola betonicifolia</i>	1	74	1	26	P
<i>Viola hederacea</i>	1	31	2	18	P
<i>Wahlenbergia gloriosa</i>	1	23	1	2	P
<i>Lomandra longifolia</i>	2	51	2	42	C
<i>Poa sieberiana</i>	3	51	2	48	C

Threatened communities: Nil

Equivalent vegetation types: This community is defined by a very large group of field survey plots, some of which (22) were also classified by Gellie (2005). These were assigned to a wide variety of Forest Ecosystems and there is no direct equivalent – related types include Community VG102 [*Brindabella Montane Dry Fern/Grass Forest*] and Community VG86 [*Western Sub-alpine Moist Shrub Forest*].

Frequently occurring weeds: Weeds are generally uncommon in this community, most likely because it is remote from major anthropogenic disturbances. Weed species that were recorded in this community are typical of other wet forest communities and include *Hypochaeris radicata* (0.42) and *Crepis capillaris* (0.15), although both are generally found in low numbers.



Plate u239: Community u239 with an open shrub layer. Alpine Creek Fire Trail, northern Kosciuszko NP.

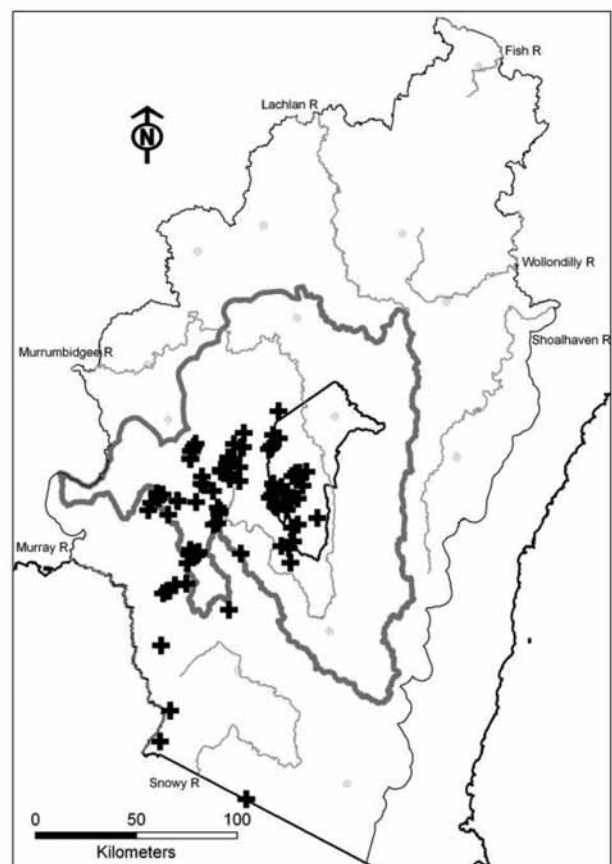


Fig. u239: Distribution of field samples assigned to this community.

Threats: The greatest threat to this community is the combined effect of high fire intensity and frequency. Because *Eucalyptus delegatensis* is an obligate seeder (Vivian & Cary 2012), hot fires at intervals of less than 20 years have the potential to eliminate the species (G. Robertson, OEH, pers. comm.).

Reservation status: There are around 100,000 hectares of *Eucalyptus delegatensis* (all community types) in NSW, with about 80,000 hectares being reserved in Kosciuszko NP and Brindabella NP. Most of the area not reserved occurs in Bago, Maragle and Ingebyra SFs (G. Robertson, OEH, pers. comm.).

Extent of clearing: This community has not been affected by clearing.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Vivian, L.M. & Cary, G.J. (2012) Relationship between leaf traits and fire-response strategies in shrub species of a mountainous region of south-eastern Australia. *Annals of Botany* 109: 197–208.

Class: Southern Tableland Wet Sclerophyll Forests

u52: Ribbon Gum – Robertson’s Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and the northern Australian Alps bioregions

Scientific Name: *Eucalyptus viminalis* – *Eucalyptus radiata* subsp. *robertsonii* / *Acacia melanoxylon* / *Rubus parvifolius* – *Cassinia aculeata* / *Pteridium esculentum* – *Clematis aristata* – *Stellaria pungens*

Number of samples:	85
Richness [mean (±SD)]:	36 (9)
Slope (degrees):	(2) 12–21 (36)
Altitude (m asl):	(426) 804–1088 (1249)
Ave. Annual Rainfall (mm):	(739) 1001–1189 (1396)
Temp. Annual Range (°C):	(24) 24.7–25.7 (28.2)

Vegetation Description: Community u52 is a very tall eucalypt forest dominated by *Eucalyptus viminalis* and *Eucalyptus radiata* subsp. *robertsonii*. *Eucalyptus fastigata* may be dominant in patches, which in the ACT can be found up to 1,320m above sea level (M. Kitchin, ACT ESDD, pers. comm.). The shrub layer of this community is open and variable in height, typically including *Acacia melanoxylon*, *Acacia dealbata*, *Cassinia aculeata*, *Lomatia myricoides* and *Coprosma quadrifida*. The moist groundlayer is a mix of forbs, ferns, climbers and grasses including *Pteridium esculentum*, *Clematis aristata*, *Stellaria pungens*, *Acaena novae-zelandiae*, *Lagenophora stipitata*, *Viola hederacea*, *Rubus parvifolius*, *Glycine clandestina*, *Asperula scoparia*, *Microlaena stipoides*, *Poa sieberiana*, *Geranium potentilloides* and *Hydrocotyle laxiflora*.

This community is prevalent in Namadgi and Brindabella NPs, but extends east to Tinderry NR, and west through Kosciuszko NP to Bondo SF near Tumut. It occupies a variety of aspects, but is most common in sheltered environments. It occurs on a variety of geologies, including rhyolite, granite, granodiorite and meta-sediments. Associated communities are moist forests and subalpine woodlands of the Australian Alps and western South Eastern Highlands bioregions. These include Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*] which occurs at higher altitude, Community u150 [*Broad-leaved Peppermint – Mountain Gum tall grass-forb open forest of the South Eastern Highlands and Australian Alps bioregions*]

on drier and more exposed sites, and Community u152 [*Robertson’s Peppermint – Red Stringybark very tall grass-forb sheltered open forest of the southwest South Eastern Highlands and upper South Western Slopes bioregions*] also on drier sites.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	Fid
<i>Acacia dealbata</i>	2	65	2	25	P
<i>Acacia melanoxylon</i>	2	68	1	12	P
<i>Acaena novae-zelandiae</i>	1	81	1	26	P
<i>Adiantum aethiopicum</i>	1	21	2	3	P
<i>Asperula scoparia</i>	1	65	2	21	P
<i>Asplenium flabellifolium</i>	1	25	1	8	P
<i>Australina pusilla</i>	1	12	2	1	P
<i>Bedfordia arborescens</i>	1	13	3	2	P
<i>Blechnum minus</i>	1	21	1	<1	P
<i>Blechnum nudum</i>	2	19	2	3	P
<i>Bursaria spinosa</i>	2	21	1	10	P
<i>Carex appressa</i>	2	29	1	6	P
<i>Cassinia aculeata</i>	1	69	1	12	P
<i>Clematis aristata</i>	1	87	1	22	P
<i>Coprosma hirtella</i>	1	46	1	11	P
<i>Coprosma quadrifida</i>	1	47	1	7	P
<i>Cynoglossum australe</i>	1	12	1	4	P
<i>Deyeuxia rodwayi</i>	2	9	1	<1	P
<i>Dianella tasmanica</i>	1	45	1	16	P
<i>Dichondra repens</i>	1	54	2	20	P
<i>Drymophila cyanocarpa</i>	1	7	1	<1	P
<i>Echinopogon ovatus</i>	1	46	1	9	P
<i>Epilobium billardierianum</i> subsp. <i>cinereum</i>	1	16	1	5	P
<i>Eucalyptus fastigata</i>	4	21	3	6	P
<i>Eucalyptus radiata</i> subsp. <i>robertsonii</i>	3	56	3	8	P
<i>Eucalyptus viminalis</i>	3	73	3	11	P
<i>Euchiton japonicus</i>	1	36	1	14	P
<i>Galium gaudichaudii</i>	1	22	1	9	P
<i>Galium polyanthum</i>	1	11	1	2	P
<i>Geranium potentilloides</i>	1	61	1	12	P
<i>Glycine clandestina</i>	1	69	1	29	P
<i>Gratiola peruviana</i>	1	18	1	1	P
<i>Gynatrix pulchella</i>	1	16	2	<1	P
<i>Hydrocotyle laxiflora</i>	1	59	2	29	P
<i>Lagenophora stipitata</i>	1	79	1	16	P
<i>Leptinella filicula</i>	1	15	1	3	P
<i>Leptospermum juniperinum</i>	1	7	2	<1	P
<i>Lobelia pedunculata</i>	1	14	1	5	P
<i>Lomatia myricoides</i>	1	60	1	10	P
<i>Luzula flaccida</i>	1	26	1	13	P
<i>Mentha diemenica</i>	1	18	1	2	P
<i>Microlaena stipoides</i>	1	65	2	33	P
<i>Olearia argophylla</i>	1	8	2	2	P
<i>Olearia erubescens</i>	1	25	1	12	P
<i>Olearia megalophylla</i>	1	20	1	4	P
<i>Olearia stellulata</i>	1	13	1	2	P
<i>Platylobium montanum</i>	1	29	2	10	P
<i>Poa helmsii</i>	1	25	2	3	P
<i>Poa tenera</i>	3	11	2	2	P
<i>Polystichum proliferum</i>	1	55	1	6	P
<i>Pomaderris aspera</i>	2	27	2	2	P
<i>Prostanthera lasianthos</i>	1	7	1	1	P
<i>Pteridium esculentum</i>	3	89	2	25	P
<i>Pterostylis coccinea</i>	1	12	1	<1	P
<i>Pterostylis decurva</i>	1	7	1	<1	P
<i>Ranunculus lappaceus</i>	1	46	1	10	P
<i>Ranunculus plebeius</i>	1	13	1	3	P
<i>Rubus parvifolius</i>	1	71	1	10	P
<i>Senecio diaschides</i>	1	28	1	5	P
<i>Senecio linearifolius</i>	1	29	1	4	P
<i>Stellaria pungens</i>	1	85	2	30	P



Plate u52: Community u52 dominated by *Eucalyptus viminalis* and *Eucalyptus radiata* subsp. *robertsonii* with scattered shrubs and a grassy understorey. Lower south-western slope of Mt. Tennent, Tennent Fire Trail, Namadgi NP.

<i>Urtica incisa</i>	1	15	1	2	P
<i>Veronica calycina</i>	1	29	1	16	P
<i>Veronica derwentiana</i>	1	11	1	<1	P
<i>Viola hederacea</i>	1	73	2	17	P
<i>Lomandra longifolia</i>	1	48	2	42	C
<i>Poa sieberiana</i>	2	64	2	48	C

Threatened communities: Nil.

Equivalent vegetation types: Most similar to Community VCA 300 [*Ribbon Gum – Narrow-leaved (Robertson’s) Peppermint montane fern-grass tall open forest on deep clay loam soils in the upper NSW SWS bioregion and western Kosciuszko escarpment*] (Benson et al. 2010) and represents a combination of Community VG82 [*Western Montane Acacia Fern/Herb Forest*], Community VG83 [*Montane Riparian Moist Shrub/Grass/Herb Forest*] and Community VG102 [*Brindabella Montane Dry Fern/Grass Forest*] (Gellie 2005).

Frequently occurring weeds: *Cirsium vulgare* (0.41) and *Rosa rubiginosa* (0.24) are the most frequently recorded weeds from this community. The prevalence of *Rosa rubiginosa*, in particular, suggests widespread past disturbance to the canopy and/or the shrub layer.

Threats: As with other forest communities, frequent and intense fire is a significant potential threat to this community. Due to the open nature of the understorey in this community, the other major risk factor is damage associated with feral herbivores.

Reservation status: Likely to be well reserved. Recorded from survey plots in Bimberi NR, Black Andrew NR, Brindabella NP and SCA, Kosciuszko NP, Namadgi NP and Tinderry NR.

Extent of clearing: Likely to be minor.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

Class: Southern Escarpment Wet Sclerophyll Forests

p338: Brown Barrel wet sclerophyll very tall grass-herb open forest primarily of the Gourock and Tallaganda Ranges in the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus fastigata* ± *Eucalyptus radiata* subsp. *radiata* – *Eucalyptus viminalis* / *Acacia dealbata* – *Leucopogon lanceolatus* / *Pteridium esculentum* / *Poa meionectes* – *Dianella tasmanica* – *Viola hederacea* – *Stellaria pungens* – *Clematis aristata*

Number of samples:	112
Richness [mean (±SD)]:	33 (8)
Slope (degrees):	(0) 5–15 (33)
Altitude (m asl):	(562) 907–1117 (1353)
Ave. Annual Rainfall (mm):	(759) 911–1005 (1144)
Temp. Annual Range (°C):	(22.7) 23.7–24.7 (25.8)

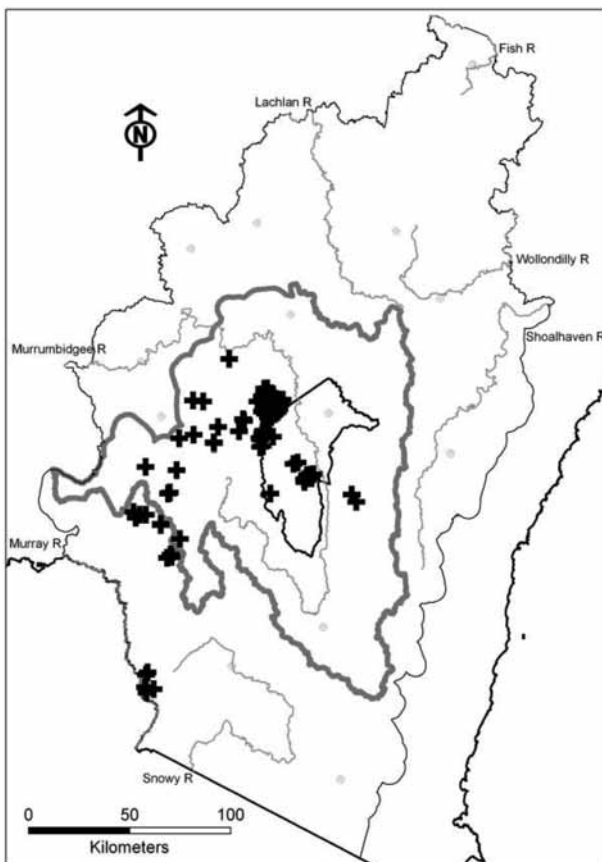


Fig. u52: Distribution of field samples assigned to this community.

Vegetation Description: Community p338 is a very tall eucalypt forest dominated by *Eucalyptus fastigata*, *Eucalyptus radiata* subsp. *radiata* and *Eucalyptus viminalis*. The shrub layer is variable in height depending on local dominance, but typically includes *Acacia dealbata*, *Leucopogon lanceolatus*, *Acacia melanoxylon*, *Coprosma quadrifida* and *Lomatia myricoides*. The moist groundlayer is a mix of ferns, forbs and grasses including *Pteridium esculentum*, *Poa meionectes*, *Dianella tasmanica*, *Viola hederacea*, *Stellaria pungens*, *Lagenophora stipitata*, *Poranthera microphylla*, *Gonocarpus tetragynus*, *Dichondra repens*, *Microlaena stipoides*, *Veronica calycina* and *Asperula scoparia*. The climber *Clematis aristata* is often present.

This community is generally confined to the western fall of the coastal escarpment within the South Eastern Highlands bioregion. It is common in sheltered environments typically on granite or meta-sedimentary geologies, but is also recorded from granodiorite and basalt substrates. Associated communities are dry forests of the Great Dividing Range including Community p8 [*Silvertop Ash – Narrow-leaved Peppermint shrubby tall dry open forest primarily on sedimentary ridges of the eastern South Eastern Highlands bioregion*] and Community e24 [*Mountain Gum – Snow Gum subalpine very tall dry shrubby open forest primarily in the Kybeyan – Gourock subregion of the South Eastern Highlands bioregion*], which both occur in more exposed locations. In the ACT and west into the Brindabellas, *Eucalyptus fastigata* stands are considered part of Community u52 [*Ribbon Gum – Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and northern Australian Alps bioregions*] rather than Community p338.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acacia dealbata</i>	2	61	2	25	P
<i>Acacia melanoxylon</i>	1	36	1	13	P
<i>Acaena novae-zelandiae</i>	2	54	1	27	P
<i>Acrothamnus hookeri</i>	2	20	1	7	P
<i>Acrotriche divaricata</i>	2	9	1	<1	P
<i>Ajuga australis</i>	1	17	1	7	P
<i>Asperula scoparia</i>	2	56	2	21	P
<i>Blechnum cartilagineum</i>	1	5	2	1	P
<i>Brachyscome formosa</i>	2	4	2	<1	P
<i>Chiloglottis pluricallata</i>	1	13	1	<1	P
<i>Chiloglottis</i> spp.	1	10	2	1	P
<i>Choretrum candollei</i>	1	4	1	<1	P
<i>Clematis aristata</i>	1	72	1	22	P
<i>Clematis</i> spp.	2	6	2	<1	P
<i>Comesperma volubile</i>	1	7	1	1	P
<i>Coprosma quadrifida</i>	1	37	1	7	P
<i>Coronidium scorpioides</i>	2	54	1	19	P
<i>Cyathea australis</i>	1	10	2	2	P
<i>Desmodium gunnii</i>	2	7	2	1	P
<i>Dianella tasmanica</i>	2	82	1	14	P
<i>Dichondra repens</i>	2	57	2	19	P
<i>Dryophila cyanocarpa</i>	2	5	1	<1	P
<i>Echinopogon ovatus</i>	1	23	1	10	P
<i>Eucalyptus cypellocarpa</i>	2	13	3	5	P
<i>Eucalyptus fastigata</i>	3	70	3	4	P
<i>Eucalyptus nitens</i>	3	8	3	<1	P
<i>Eucalyptus obliqua</i>	3	17	3	3	P
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>	2	48	3	10	P
<i>Eucalyptus viminalis</i>	3	43	3	12	P
<i>Galium leiocarpum</i>	1	15	1	4	P
<i>Geranium potentilloides</i>	2	32	1	12	P
<i>Glycine clandestina</i>	2	61	1	29	P
<i>Goodia lotifolia</i>	1	8	1	1	P
<i>Hakea eriantha</i>	1	20	1	1	P
<i>Helichrysum leucopsideum</i>	1	6	1	<1	P
<i>Hydrocotyle acutiloba</i>	2	7	1	2	P
<i>Lagenophora stipitata</i>	2	71	1	15	P
<i>Leptinella filicula</i>	2	17	1	3	P

<i>Leucopogon lanceolatus</i>	2	56	2	11	P
<i>Lobelia puberula</i>	1	9	1	<1	P
<i>Lomandra longifolia</i>	2	68	2	41	P
<i>Lomatia fraseri</i>	2	12	1	1	P
<i>Lomatia myricoides</i>	2	27	1	11	P
<i>Luzula flaccida</i>	1	24	1	13	P
<i>Microlaena stipoides</i>	1	57	2	33	P
<i>Olearia megalophylla</i>	1	12	1	5	P
<i>Persoonia silvatica</i>	1	23	1	2	P
<i>Plantago debilis</i>	2	12	2	4	P
<i>Poa ensiformis</i>	2	7	2	2	P
<i>Poa meionectes</i>	3	87	2	14	P
<i>Polyscias sambucifolia</i> subsp. <i>sambucifolia</i>	2	11	1	1	P
<i>Polystichum proliferum</i>	1	17	1	7	P
<i>Poranthera microphylla</i>	1	66	1	26	P
<i>Pteridium esculentum</i>	3	89	2	25	P
<i>Ranunculus pimpinellifolius</i>	2	5	1	1	P
<i>Rubus parvifolius</i>	1	28	1	11	P
<i>Schelhammera undulata</i>	2	4	2	<1	P
<i>Senecio prenanthoides</i>	1	55	1	18	P
<i>Smilax australis</i>	2	21	2	2	P
<i>Stellaria pungens</i>	2	73	2	30	P
<i>Tasmania lanceolata</i>	1	17	1	3	P
<i>Veronica calycina</i>	1	57	1	15	P
<i>Viola hederacea</i>	2	81	2	16	P
<i>Xerochrysum bracteatum</i>	1	17	1	1	P
<i>Gonocarpus tetragynus</i>	1	57	2	47	C

Threatened communities: Nil.

Equivalent vegetation types: Community WSFp338 [*Southern Range Wet Forest*] (Tozer et al. 2010) and a combination of Community VG55 [*Eastern Tableland Fern/Herb/Grass Moist Forest*], Community VG56 [*Tableland and Escarpment Moist Herb/Gern/Grass Forest*] and Community VG95 [*Tableland Acacia Moist Herb Forest*] (Gellie 2005).

Frequently occurring weeds: Compared with many communities, this community is relatively undisturbed and consequently weed species are uncommon. Nonetheless the highly dispersible *Hypochaeris radicata* (0.74) is present at low abundances in the majority of sites.

Threats: Because large areas of this community occur in State Forest, logging and its associated impacts may alter species composition and vegetation condition. Frequent and intense fire also has the potential to impact upon this community.

Reservation status: Likely to be well reserved. Recorded from survey plots in Badja Swamps NR, Bondi Gulf NR, Coolumbooka NR, Deua NP, Gourock NP, Monga NP and SCA, Southeast Forest NP, Tallaganda NP, Tallaganda SCA and Wadbilliga NP.

Extent of clearing: Not assessed, but likely to be minor due to its generally steep mountainous habitat.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.



Plate p338: An example of Community p338 dominated by *Eucalyptus fastigata*, *Eucalyptus radiata* subsp. *radiata* and *Eucalyptus cypellocarpa*, with *Leucopogon lanceolata*, *Dianella tasmanica* and *Pteridium esculentum* in the understorey. Cattlemans Link Firetrail, South East Forests NP.

Formation: Dry Sclerophyll Forests

Class: Southern Tableland Dry Sclerophyll Forests

e24: Mountain Gum – Snow Gum very tall dry shrubby open forest primarily in the Kybeyan – Gourock subregion of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus dalrympleana* – *Eucalyptus pauciflora* subsp. *pauciflora* – *Eucalyptus radiata* subsp. *radiata* / *Persoonia silvatica* – *Monotoca scoparia* / *Lomandra longifolia* – *Poa meionectes* – *Stylidium graminifolium sens. lat.* – *Dianella tasmanica*

Number of samples:	30
Richness [mean (±SD)]:	25 (8)
Slope (degrees):	(0) 2–8 (21)
Altitude (m asl):	(758) 922–1147 (1351)
Ave. Annual Rainfall (mm):	(809) 879–1036 (1120)
Temp. Annual Range (°C):	(22.7) 23.5–24.2 (25.6)

Vegetation Description: Community e24 is a very tall dry shrubby open forest dominated by *Eucalyptus dalrympleana*, often with *Eucalyptus pauciflora* subsp. *pauciflora* or *Eucalyptus radiata* subsp. *radiata*. The shrub layer is generally patchy, with species such as *Persoonia silvatica*, *Bossiaea foliosa*, *Monotoca scoparia*, *Daviesia ulicifolia* and the tall shrubs *Acacia dealbata* and *Exocarpos strictus*. The groundlayer is usually sparse and dominated by leaf litter and woody debris, with patches of forbs including *Lomandra longifolia*, *Stylidium graminifolium sens. lat.*, *Dianella tasmanica* and *Gonocarpus tetragynus* and grasses including *Poa meionectes* and *Poa sieberiana*.

This community is distributed along the western fall of the Great Dividing Range from Tallaganda NP in the north and extending south to the Bombala area. It is generally found on loamy forest soils of low fertility. This community generally occurs in a mosaic with Community p338 [*Brown Barrel wet sclerophyll very tall grass-herb open forest primarily of the Gourock and Tallaganda Ranges in the South Eastern Highlands bioregion*] occurring on more sheltered aspects on better soils. It is often increasingly dominated by *Eucalyptus pauciflora* subsp. *pauciflora* at higher altitude within its range.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	Fid
<i>Banksia marginata</i>	2	30	1	3		P
<i>Bossiaea foliosa</i>	2	63	2	4		P
<i>Choretrum pauciflorum</i>	1	20	1	3		P
<i>Daviesia ulicifolia</i>	2	57	2	10		P
<i>Dianella tasmanica</i>	2	67	1	16		P
<i>Eucalyptus dalrympleana</i>	3	80	3	19		P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	3	60	3	21		P
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>	3	50	3	10		P
<i>Exocarpos strictus</i>	2	40	1	12		P
<i>Gompholobium huegelii</i>	1	27	1	5		P
<i>Hovea linearis</i>	1	47	1	13		P
<i>Lomandra longifolia</i>	2	80	2	42		P
<i>Monotoca scoparia</i>	2	60	1	14		P
<i>Patersonia sericea</i> var. <i>sericea</i>	2	27	2	3		P
<i>Persoonia chamaepeuce</i>	2	33	1	11		P
<i>Persoonia silvatica</i>	1	67	1	3		P

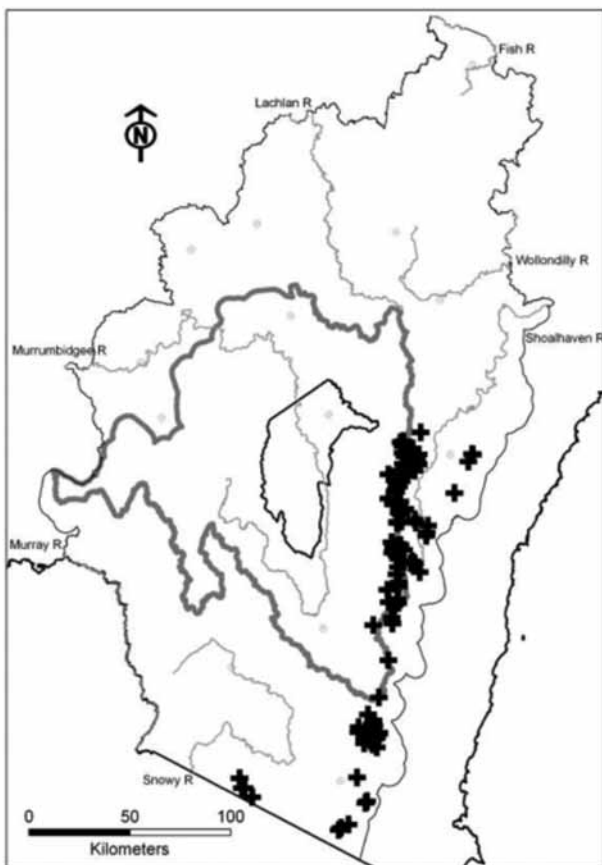


Fig. p338: Distribution of field samples assigned to this community

<i>Poa meionectes</i>	2	67	2	16	P
<i>Polyscias sambucifolia</i> subsp. <i>sambucifolia</i>	2	20	1	1	P
<i>Styliidium graminifolium sens. lat.</i>	2	70	1	25	P
<i>Acacia dealbata</i>	1	43	2	26	C
<i>Coronidium scorpioides</i>	2	40	1	20	C
<i>Gonocarpus tetragynus</i>	2	67	2	48	C
<i>Hibbertia obtusifolia</i>	1	40	1	35	C
<i>Lomandra multiflora</i>	1	40	1	18	C
<i>Microlaena stipoides</i>	1	57	2	34	C

Threatened communities: Components of this community may contain TSC Act 1995 – *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions.*

Equivalent vegetation types: Community DSFe24 [*Subalpine Dry Shrub Forest*] (Tozer et al. 2010), with DSFe24 contains a moderate frequency of *Eucalyptus dives* east of the study area. Some similarities with VG64 [*South East Tableland Edge Shrub/Grass Dry Forest*] (Gellie 2005).

Frequently occurring weeds: Weed species are uncommon throughout this community. The most commonly recorded species is *Hypochaeris radicata* (0.37), which is a highly dispersible species often found at low abundance in extensively forested environments.

Threats: There are very few threats to the long-term structure and composition of this community, largely because it is well reserved and it has limited value to forestry (BRS & SFNSW, 1999). The biggest potential threat to this community is via frequent and intense fire, which may alter community floristics and structure over time.

Reservation status: Unknown, although examples of this community are found in Badja Swamps NR, Coolumbooka NR, Dangelong NR, Deua NP, Good Good NR, Gourock NP, South East Forest NP, Tallaganda NP, Tallaganda SCA and Wadbilliga NP.

Extent of clearing: Considered minimal.

References: BRS & SFNSW (1999) A report on forest wood resources for Southern NSW CRA Region. Bureau of Rural Sciences and State Forests of NSW New South Wales Government, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.



Plate e24: Community e24 dominated by *Eucalyptus dalrympleana*, with an open shrub layer of *Bossiaea foliosa* and a patchy understorey of *Poa* spp. and *Microlaena stipoides* var. *stipoides*. Plot UMC219, west of Glenbog SF.

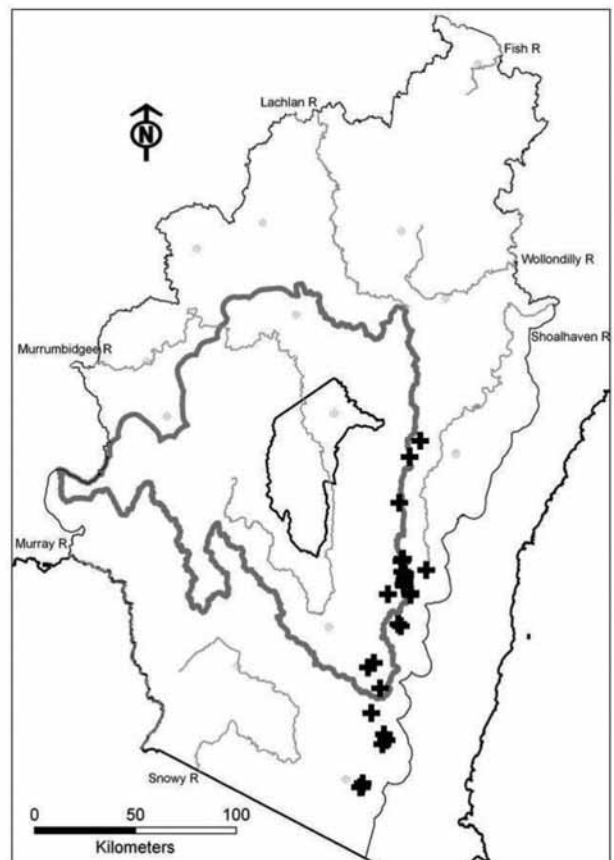


Fig. e24: Distribution of field samples assigned to this community.

m31: Ribbon Gum – Snow Gum – *Cassinia longifolia* tall shrub-grass open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus viminalis* – *Eucalyptus pauciflora* subsp. *pauciflora* / *Cassinia longifolia* – *Acacia dealbata* / *Poa sieberiana* – *Elymus scaber* – *Gonocarpus tetragynus* – *Microlaena stipoides*

Number of samples:	42
Richness [mean (±SD)]:	35 (10)
Slope (degrees):	(4) 7–15 (25)
Altitude (m asl):	(721) 815–947 (1112)
Ave. Annual Rainfall (mm):	(527) 586–694 (846)
Temp. Annual Range (°C):	(23.8) 25.6–26.2 (27.7)

Vegetation Description: Community m31 is a tall open forest to woodland dominated by *Eucalyptus viminalis* and *Eucalyptus pauciflora* subsp. *pauciflora*, frequently with *Eucalyptus rubida* as a co-dominant. A patchy to sparse shrub layer is commonly present, frequently including *Cassinia longifolia* and *Acacia dealbata*, with a groundlayer consisting of a moderately diverse range of grasses, forbs and hard-leaved low shrubs. Commonly occurring species include *Poa sieberiana*, *Elymus scaber*, *Chrysocephalum semipapposum*, *Gonocarpus tetragynus*, *Euchiton japonicus*, *Hypericum gramineum*, *Acaena echinata*, *Microlaena stipoides*, *Hibbertia obtusifolia* and *Scleranthus biflorus*.

Field plots assigned to this community were recorded from gullies and footslopes of minor watercourses on moderately low fertility siliceous substrates along eastern ranges of the tablelands from Tinderry NR south to Cooma and Nimmitabel, with a disjunct occurrence further south in the Merriangaah area. Many records are from the Coomarrtha-Numeralla-Countegany area. Within this range, this community is found primarily on Adaminaby Group sandstones but also from metamorphics (quartzite and schist) and Glenbog Granodiorite. This community is likely to be restricted to narrow areas of moist deeper soil along drainage lines, grading into Community u21 [*Broad-leaved Peppermint – Candlebark tall dry sclerophyll open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps bioregions*] on sheltered footslopes and Community m51 [*Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll open forest on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan – Gourock subregions of the South Eastern Highlands*] on exposed stony slopes and ridges. As annual rainfall increases to the east and at higher altitudes, this community is replaced in similar moist sandy alluvium habitats by Community p520 [*Ribbon Gum very tall woodland on alluvial soils along drainage lines of the eastern South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	Freq	Fid
<i>Acacia dealbata</i>	2	81	2	25	P
<i>Acacia rubida</i>	2	29	1	6	P
<i>Acaena echinata</i>	1	50	1	9	P
<i>Acaena novae-zelandiae</i>	2	52	1	27	P
<i>Ajuga australis</i>	1	29	1	8	P
<i>Bossiaea buxifolia</i>	1	33	1	7	P
<i>Cassinia longifolia</i>	2	88	1	15	P
<i>Chrysocephalum semipapposum</i>	2	55	1	4	P
<i>Daucus glochidiatus</i>	1	24	1	8	P
<i>Desmodium varians</i>	1	36	1	12	P
<i>Dichondra repens</i>	2	45	2	20	P
<i>Echinopogon ovatus</i>	1	43	1	10	P
<i>Elymus scaber</i>	1	69	1	20	P

<i>Epilobium billardierianum</i> subsp. <i>cinereum</i>	1	24	1	5	P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	3	64	3	20	P
<i>Eucalyptus rubida</i>	3	43	3	8	P
<i>Eucalyptus viminalis</i>	3	71	3	12	P
<i>Euchiton japonicus</i>	1	55	1	15	P
<i>Exocarpos strictus</i>	1	31	1	12	P
<i>Geranium neglectum</i>	1	21	2	2	P
<i>Hypericum gramineum</i>	1	55	1	25	P
<i>Leucopogon fletcheri</i> subsp. <i>brevisepalus</i>	1	21	1	3	P
<i>Melichrus urceolatus</i>	1	43	1	13	P
<i>Mirbelia oxylobioides</i>	3	19	1	3	P
<i>Oxalis</i> spp.	1	21	1	3	P
<i>Plantago varia</i>	1	33	1	11	P
<i>Poa sieberiana</i>	2	74	2	48	P
<i>Pultenaea procumbens</i>	1	21	1	4	P
<i>Rumex brownii</i>	1	38	1	9	P
<i>Rytidosperma racemosum</i>	1	40	2	10	P
<i>Scleranthus biflorus</i>	1	40	1	10	P
<i>Veronica perfoliata</i>	1	21	1	4	P
<i>Veronica plebeia</i>	1	19	1	6	P
<i>Viola betonicifolia</i>	1	52	1	27	P
<i>Glycine clandestina</i>	1	45	1	29	C
<i>Gonocarpus tetragynus</i>	2	62	2	48	C
<i>Hibbertia obtusifolia</i>	1	45	1	35	C
<i>Hydrocotyle laxiflora</i>	1	40	2	30	C
<i>Microlaena stipoides</i>	2	55	2	34	C
<i>Themeda australis</i>	1	40	2	21	C

Threatened communities: Components of this community may contain TSC Act 1995– *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions*.

Equivalent vegetation types: This community has no direct equivalent in the Forest Ecosystem classification of Gellie (2005), however it includes many of the plots that were assigned by those studies to Community VG73 [*Eastern Tableland Dry Shrub/Grass Forest*] and Community VG74 [*South Eastern Tablelands Dry Shrub/Grass/Herb Forest*].

Frequently occurring weeds: The greater diversity of weed species found in this community relative to other forested communities in the region might be attributed to the moist, deep soil on which it generally occurs. The most commonly recorded species were *Acetosella vulgaris* (0.21), *Centaurium erythraea* (0.28), *Cirsium vulgare* (0.18), *Hypochaeris radicata* (0.62), and *Trifolium arvense* (0.21), each of which is typical of pastoral environments. This may also indicate some past clearing and/or grazing by domestic stock in this community.

Threats: Although this community occupies relatively moist and productive sites, these generally occupy narrow zones within dry siliceous hills and ranges in dissected terrain. As a result this community is unlikely to have been extensively cleared, although larger examples of the type may have been historically thinned or cleared of trees to encourage pasture growth for grazing stock. Examples of this type on private land are likely to be subject to occasional ongoing light grazing. Its moister landscape position means this type is likely to be prone to ongoing weed invasion, particularly exotic pasture species spread by grazing animals.

Reservation status: Most of the plots assigned to this community were sampled in conservation reserves, including Coomarrtha NR, Dangelong NR, Macanally SCA, Merriangaah NR, Mount Clifford NR, Numeralla NR, Quidong NR, Strike-a-Light NR, Tinderry NR, Undoo NR and Wadjan NR.

Extent of clearing: Likely to be minor.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate m31: Community m31 beside the Murrumbidgee River near Cooma water filtration plant (plot UMC424), with *Eucalyptus viminalis* above scattered *Acacia dealbata*, *Leptospermum obovatum* and a moist riparian herbaceous groundcover.

m51: Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll open forest on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan – Gourock subregions of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus mannifera* – *Eucalyptus rossii* – *Eucalyptus macrorhyncha* – *Eucalyptus dives* / *Hibbertia obtusifolia* – *Melichrus urceolatus* / *Rytidosperma pallidum* – *Pultenaea procumbens* – *Dianella revoluta*

Number of samples: 50
 Richness [mean (±SD)]: 21 (7)
 Slope (degrees): (1) 6–17 (26)
 Altitude (m asl): (771) 851–971 (1196)
 Ave. Annual Rainfall (mm): (539) 591–683 (801)
 Temp. Annual Range (°C): (24.5) 25.6–26.5 (27)

Vegetation Description: Community m51 is a tall eucalypt open forest to woodland with a canopy 10 to 15m tall dominated by *Eucalyptus mannifera* and *Eucalyptus rossii*, commonly with *Eucalyptus dives* and/or *Eucalyptus macrorhyncha*. Shrubs are absent to patchy and a sparse to moderate groundlayer is dominated by a relatively depauperate mix of low shrubs, forbs and grasses, including *Hibbertia obtusifolia*, *Rytidosperma pallidum*, *Dianella revoluta*, *Pultenaea procumbens*, *Melichrus urceolatus* and *Brachyloma daphnoides*.

This community is distributed from the Captains Flat and Burra areas in the north, south along the Tinderry Range and Black Range to Numeralla and Sunny Corner, with disjunct occurrences in the far south from Merriangaah and Quidong on Sherwins Range and Gibraltar Ridge. Within this range, Community m51 occurs on siliceous, moderate to low fertility substrates, occurring primarily on Adaminaby Group sediments (sandstones, siliceous siltstones and mudstones), but also on Jerangle and Cooma Metamorphics and Glenbog Granodiorite.

Community m51 may grade into Community u21 [*Broad-leaved Peppermint – Candlebark tall dry sclerophyll open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps bioregions*] on deeper soils on footslopes and flats, and in sheltered gullies may be replaced by Community m31 [*Ribbon Gum – Snow Gum – Cassinia longifolia tall shrub-grass open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands bioregion*]. On similar exposed landscape positions with siliceous substrates north of Queanbeyan, this community is replaced by the related Community p14 [*Red Stringybark – Scribbly Gum – Rytidosperma pallidum tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia buxifolia</i>	1	14	1	1			P
<i>Acacia falciformis</i>	2	26	2	7			P
<i>Acacia gunnii</i>	1	26	1	6			P
<i>Acacia rubida</i>	1	46	1	5			P
<i>Bossiaea buxifolia</i>	1	32	1	7			P
<i>Brachyloma daphnoides</i>	1	62	1	16			P
<i>Brachyscome rigidula</i>	1	14	1	2			P
<i>Callitris endlicheri</i>	3	16	2	1			P
<i>Cassinia longifolia</i>	1	34	1	16			P
<i>Choretrum pauciflorum</i>	2	14	1	3			P
<i>Daviesia leptophylla</i>	1	22	1	5			P
<i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>	1	24	2	9			P
<i>Dianella revoluta</i>	1	66	1	22			P
<i>Dillwynia sericea</i>	1	24	1	4			P

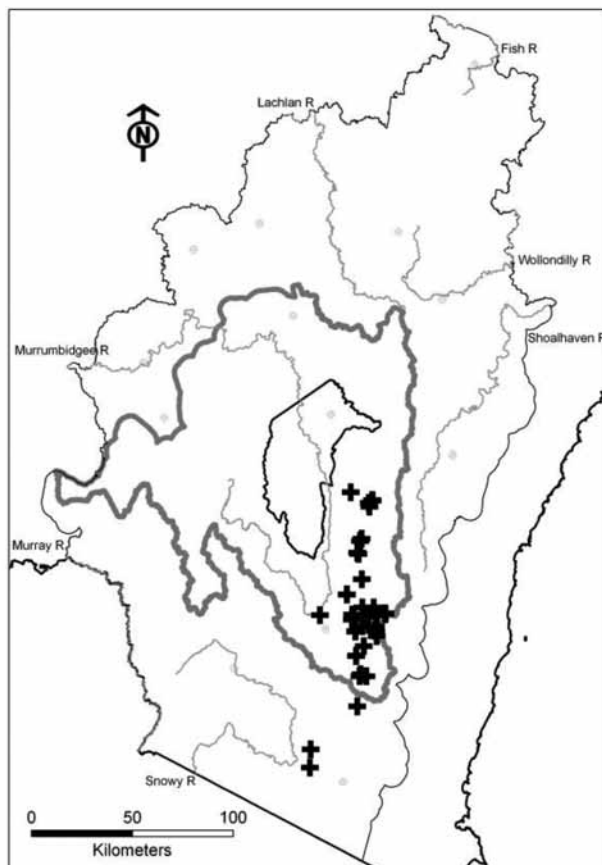


Fig. m31: Distribution of field samples assigned to this community.



Plate m51: *Eucalyptus mannifera* with hardy shrub taxa typical of plant community m51, adjacent to Dangelong NR, Nimmitabel.

<i>Eucalyptus dives</i>	3	50	3	18	P
<i>Eucalyptus macrorhyncha</i>	3	46	3	15	P
<i>Eucalyptus mannifera</i>	3	80	2	10	P
<i>Eucalyptus rossii</i>	3	58	3	7	P
<i>Hibbertia obtusifolia</i>	1	84	1	34	P
<i>Leucopogon ericoides</i>	3	18	1	<1	P
<i>Leucopogon microphyllus</i>	3	22	2	1	P
<i>Melichrus urceolatus</i>	1	62	1	12	P
<i>Persoonia rigida</i>	1	50	1	2	P
<i>Platysace lanceolata</i>	2	18	2	5	P
<i>Pultenaea procumbens</i>	2	66	1	4	P
<i>Rytidosperma pallidum</i>	3	80	2	17	P
<i>Veronica perfoliata</i>	1	22	1	4	P
<i>Gonocarpus tetragynus</i>	1	54	2	48	C
<i>Lomandra longifolia</i>	1	58	2	42	C

Threatened communities: Nil.

Equivalent vegetation types: Community m51 has no direct equivalent in the Forest Ecosystem classification of Gellie (2005), however it includes a number of plots that were assigned to Community VG115 [*South East Tablelands Dry Shrub/Tussock Grass Forest*].

Frequently occurring weeds: Due to the relatively infertile substrate of this community it is generally low in diversity and abundance of weeds, with *Hypochaeris radicata* (0.07) being the most commonly recorded.

Threats: This community occupies relatively infertile and dry rocky slopes and is likely to have suffered only minor clearing across its range. Examples on private land may be subject to stock grazing, but are unlikely to support high stocking rates. Weed invasion is not a significant problem for this community.

Reservation status: Due to the infertile, steep, dry rocky habitat of this community, it is well represented in conservation reserves. This community has been sampled from many conservation reserves across its range, including Burra Creek NR, Yanununbeyan SCA, Tinderry NR, Mount Dowling NR, Macanally NR, Coornatha NR, Kybeyan NR and Merriangaah NR.

Extent of clearing: Only minor clearing likely.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

p8: Silvertop Ash – Narrow-leaved Peppermint shrubby tall dry open forest primarily on sedimentary ridges of the eastern South Eastern Highlands bioregion

Scientific Name: *Eucalyptus sieberi* – *Eucalyptus radiata* subsp. *radiata* / *Leucopogon lanceolatus* – *Persoonia linearis* – *Hibbertia obtusifolia* – *Pteridium esculentum* / *Gonocarpus tetragynus* – *Lomandra longifolia* – *Poa sieberiana*

Number of samples:	83
Richness [mean (±SD)]:	26 (8)
Slope (degrees):	(1) 6–17 (31)
Altitude (m asl):	(648) 806–994 (1190)
Ave. Annual Rainfall (mm):	(694) 856–956 (1069)
Temp. Annual Range (°C):	(22.6) 24.2–25.2 (26.2)

Vegetation Description: Community p8 is a dry open forest with a tall tree canopy characteristically dominated by *Eucalyptus sieberi*, with or without other eucalypts of dry sites including *Eucalyptus radiata* subsp. *radiata* or *Eucalyptus dives*, and north of the upper Murrumbidgee catchment, *Eucalyptus blaxlandii*. This community typically has an open understorey with a sparse complement of hard-leaved tall shrubs,

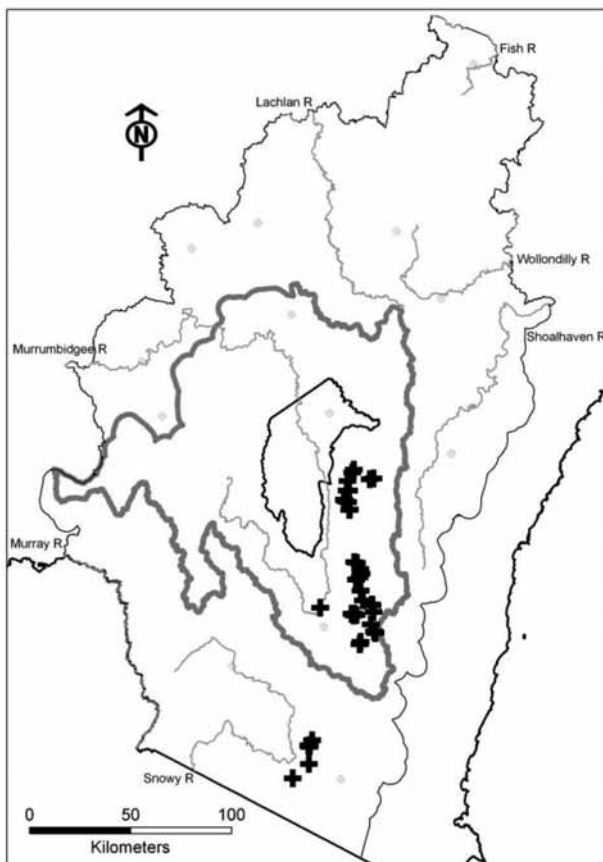


Fig. m51: Distribution of field samples assigned to this community.

including *Acacia terminalis*, *Persoonia linearis* and *Podolobium ilicifolium* and shorter shrubs such as *Leucopogon lanceolatus*, *Monotoca scoparia* and the scrambling *Billardiera scandens*. The groundlayer is often dominated by leaf litter and rock, with sparse and scattered plant cover of *Gonocarpus tetragynus*, *Pteridium esculentum*, *Lomandra longifolia*, *Poa sieberiana*, *Dianella revoluta* and *Hibbertia obtusifolia*.

This community occurs primarily on dry exposed ridges and slopes with shallow to skeletal soils of moderately low to low soil fertility derived from a range of quartz-rich sedimentary, acid-volcanic and igneous substrates. It is found extensively on the eastern tablelands, from Jenolan south along the Kanangra Range to Mount Werong, Wiarborough, Wombeyan Caves, the Cookbundoon Range, Currawang, the Gourock, Butmaroo and Bendoura Ranges to the Kybeyan Range (Countegany), and east of Braidwood from Charleys Forest to Northangera and Monga. It extends further to the east beyond the current study area (see Tozer et al. 2010).

Community p8 is often associated with Community WSFp73 (described by Tozer et al. 2010) north of the study area, and Community p338 [*Brown Barrel wet sclerophyll very tall grass-herb open forest primarily of the Gourock and Tallaganda Ranges in the South Eastern Highlands bioregion*] in the south of its range. Both of these communities occur on deeper, moister soils of lower slopes and more sheltered aspects than Community p8.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia falciformis</i>	1	28	2	7			P
<i>Acacia gunnii</i>	1	18	1	6			P
<i>Acacia obliquinervia</i>	1	12	2	3			P
<i>Acacia obtusifolia</i>	2	10	2	1			P
<i>Acacia terminalis</i>	2	34	1	3			P
<i>Acacia ulicifolia</i>	1	10	1	2			P
<i>Amperea xiphioclada</i>	2	19	1	1			P
<i>Austrostipa rudis</i>	2	12	1	3			P
<i>Banksia spinulosa</i> var. <i>spinulosa</i>	2	34	2	1			P
<i>Billardiera scandens</i>	1	49	1	8			P
<i>Bossiaea obcordata</i>	2	7	2	<1			P
<i>Comesperma volubile</i>	1	7	1	1			P
<i>Dampiera purpurea</i>	1	8	2	<1			P
<i>Daviesia ulicifolia</i>	2	22	2	10			P
<i>Dianella caerulea</i>	1	27	1	5			P
<i>Dianella revoluta</i>	2	52	1	22			P
<i>Eucalyptus blaxlandii</i>	2	14	2	<1			P
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>	3	58	3	10			P
<i>Eucalyptus sieberi</i>	3	89	3	6			P
<i>Eucalyptus smithii</i>	3	10	1	<1			P
<i>Gonocarpus tetragynus</i>	2	73	2	47			P
<i>Goodenia bellidifolia</i>	1	6	2	1			P
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	2	40	2	16			P
<i>Goodenia</i> spp.	1	6	1	<1			P
<i>Hakea dactyloides</i>	2	17	2	2			P
<i>Hakea eriantha</i>	2	10	1	2			P
<i>Hardenbergia violacea</i>	1	34	1	14			P
<i>Hibbertia diffusa</i>	2	6	2	<1			P
<i>Hibbertia obtusifolia</i>	2	77	1	34			P
<i>Hibbertia serpyllifolia</i>	2	6	2	<1			P
<i>Lepidosperma urophorum</i>	2	19	2	1			P
<i>Leucopogon lanceolatus</i>	2	73	2	11			P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	36	2	18			P
<i>Lomandra glauca</i>	2	23	2	4			P
<i>Lomandra longifolia</i>	2	67	2	42			P
<i>Lomandra multiflora</i>	2	36	1	18			P
<i>Lomandra obliqua</i>	2	24	2	3			P
<i>Lomatia ilicifolia</i>	1	22	1	3			P
<i>Lomatia silaifolia</i>	2	22	2	<1			P
<i>Monotoca scoparia</i>	2	54	1	14			P

<i>Patersonia glabrata</i>	2	18	2	1	P
<i>Patersonia sericea</i> var. <i>sericea</i>	1	19	2	3	P
<i>Persoonia laurina</i>	1	8	1	<1	P
<i>Persoonia linearis</i>	1	75	1	9	P
<i>Phyllanthus hirtellus</i>	2	8	1	1	P
<i>Platysace ericoides</i>	2	14	2	<1	P
<i>Podolobium ilicifolium</i>	2	46	2	2	P
<i>Polyscias sambucifolia</i> subsp. <i>decomposita</i>	1	12	2	<1	P
<i>Polyscias sambucifolia</i> subsp. <i>sambucifolia</i>	2	8	1	1	P
<i>Pomax umbellata</i>	2	28	2	5	P
<i>Pteridium esculentum</i>	2	70	2	26	P
<i>Rhytidisporum procumbens</i>	2	14	1	3	P
<i>Rytidosperma fulvum</i>	3	8	2	1	P
<i>Tetralochea thymifolia</i>	1	11	1	<1	P
<i>Xanthorrhoea concava</i>	2	7	2	1	P
<i>Poa sieberiana</i>	2	53	2	48	C

Threatened communities: Nil.

Equivalent vegetation types: This community is equivalent to Community DSFp8 [*Tableland Ridge Forest*] identified by Tozer et al. (2010), with the addition of a small number of new plots from the Monga area and some minor reallocations of plots between this group and the closely related Community DSFp73. It includes a number of plots allocated by Gellie (2005) to Community VG59 [*Eastern Tableland and Escarpment Shrub/Fern Dry Forest*] and Community VG112 [*Eastern Tablelands Dry Shrub Forest*].

Frequently occurring weeds: Weeds are rare probably because the community occurs on soils of low fertility. The most commonly observed species were *Hypochaeris radicata* (0.1), *Oxalis corniculata* (0.03), *Taraxacum officinale* (0.03).

Threats: The steep, dissected, infertile habitat of this type is likely to have largely protected it from broadscale clearing. Parts of its range are within State Forest and private lands subject to logging and grazing. Weed invasion is not a significant threat.

Reservation status: Recorded from within Kanangra–Boyd NP, Blue Mountains NP, Mares Forest NP, Tallaganda NP and SCA, Monga NP and SCA, Budawang NP and Deua NP. Many other reserves have records of p8 immediately adjacent and are likely to contain areas of this type; these reserves include Tarlo River NP, Cookbundoon NR, Gourock NP and Wadbilliga NP.

Extent of clearing: Likely to be minor and scattered, largely restricted to slightly flatter or marginally more fertile examples and edges where this type adjoins habitats more suitable for agricultural development.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.



Plate p8: Community p8 with *Eucalyptus sieberi* and *Eucalyptus radiata* subsp. *radiata* over a diverse low shrub layer and sparse groundcover, Palerang Fire Trail, Tallaganda SCA.



Plate p9: Community p9 with *Eucalyptus rossii*, *Eucalyptus macrorhyncha* and a sparse understorey dominated by *Rytidosperma pallidum*, on Governor's Hill above Goulburn (plot TOW005HQ).

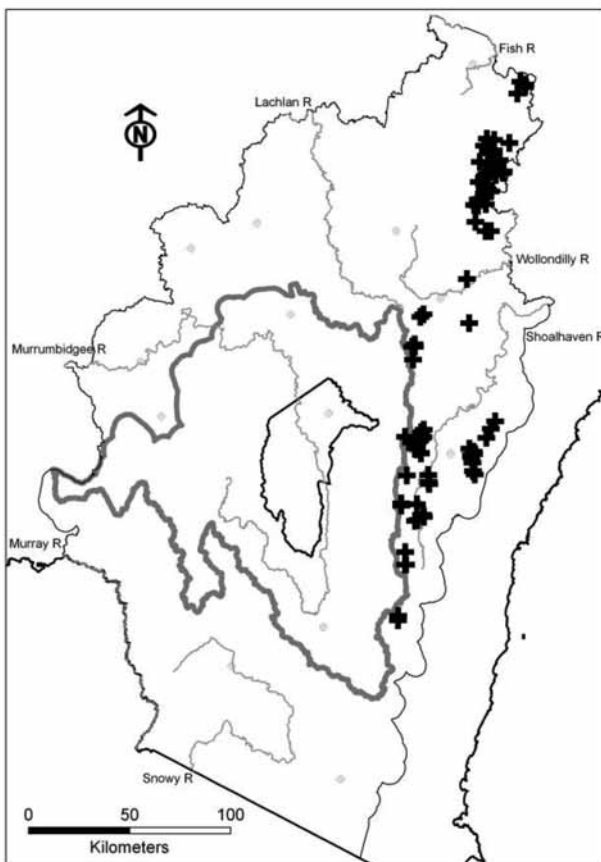


Fig. p8: Distribution of field samples assigned to this community.

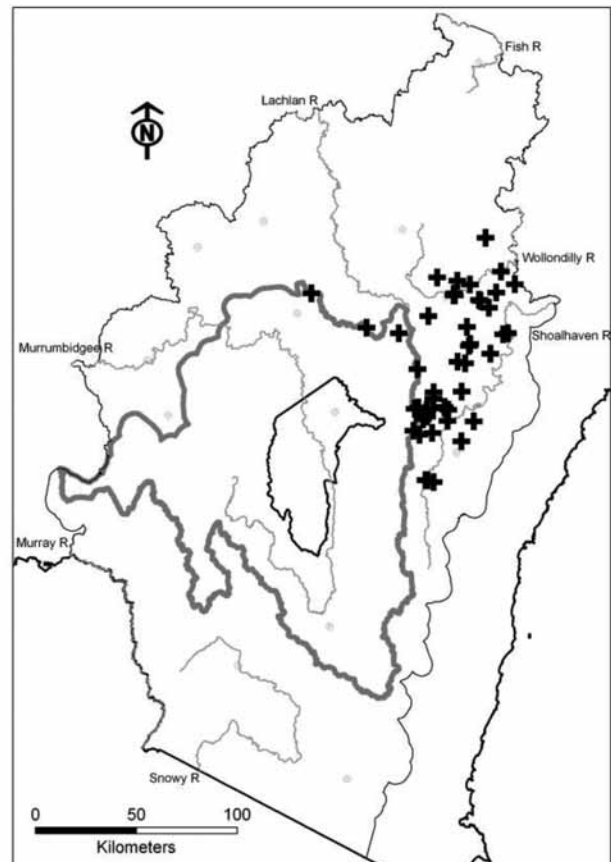


Fig. p9: Distribution of field samples assigned to this community.

p9: Brittle Gum – Scribbly Gum shrubby tall dry open forest on infertile low ridges and hills primarily of the Bungonia subregion of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus mannifera* – *Eucalyptus rossii* / *Allocasuarina littoralis* / *Melichrus urceolatus* – *Brachyloma daphnoides* – *Hibbertia obtusifolia* / *Goodenia hederacea* subsp. *hederacea* – *Gonocarpus tetragynus* – *Lomandra filiformis* subsp. *coriacea* – *Microlaena stipoides* – *Rytidosperma pallidum*

Number of samples: 51
 Richness [mean (±SD)]: 30 (8)
 Slope (degrees): (0) 3–8 (20)
 Altitude (m asl): (560) 649–762 (918)
 Ave. Annual Rainfall (mm): (669) 701–754 (893)
 Temp. Annual Range (°C): (24.7) 25.7–26.2 (26.6)

Vegetation Description: Community p9 is a tall, dry eucalypt woodland to open forest, with a tree canopy commonly dominated by *Eucalyptus mannifera* and/or *Eucalyptus rossii*, often associated with *Eucalyptus dives* and *Eucalyptus macrorhyncha*. A sparse to patchy small tree stratum of *Allocasuarina littoralis* is commonly present, above a sparse understorey of shrubs including *Persoonia linearis*, *Acacia gunnii*, *Daviesia leptophylla* and *Kunzea ericoides*. Groundlayer plants are generally sparse but reasonably diverse, including scattered low shrubs such as *Brachyloma daphnoides*, *Dillwynia sericea*, *Hibbertia obtusifolia*, *Leucopogon virgatus*, *Lissanthe strigosa* and *Melichrus urceolatus*, the grasses *Aristida ramosa*, *Rytidosperma pallidum*, *Microlaena stipoides* and *Poa sieberiana* and the forbs *Dianella revoluta*, *Gonocarpus tetragynus*, *Goodenia hederacea* subsp. *hederacea*, *Lepidosperma gunnii*, *Lomandra filiformis* subsp. *coriacea*, *Lomandra multiflora*, *Opercularia diphylla*, *Hypericum gramineum* and *Lomandra longifolia*.

This community occurs on soils of moderately low to low fertility, derived most commonly from sandstones, quartzites, conglomerates and shales of the Adaminaby, Mount Fairy and Lambie Groups, and, in the Boro, Manar, Bungonia and Marulan areas, on acid volcanic and granitic substrates. This community extends from Big Hill west to Kingsdale, Yarra, Collector and Bellmount, south to Tarago, Butmaroo, Mulloon and Warri and east to Braidwood, Nadgigomar, Windellama, Bungonia, Marulan and Brayton. Within this range, p9 may grade into Community p10 [*Black She-oak* – *Silvertop Ash tall shrubby dry sclerophyll open forest primarily in the Bungonia subregion of the South Eastern Highlands bioregion*] on sheltered slopes and slightly deeper soils of hills and ridges, while on footslopes it may grade into Community p23 [*Red Stringybark* – *Broad-leaved Peppermint tall dry sclerophyll grassy open forest on loamy rises primarily in the Bungonia subregion of the South Eastern Highlands bioregion*]. To the west and north of its range it is replaced in similar habitats by the related Community p14 [*Red Stringybark* – *Scribbly Gum* – *Rytidosperma pallidum tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	Freq	O	Fid
<i>Acacia gunnii</i>	1	25	1	6		P
<i>Allocasuarina littoralis</i>	2	52	2	3		P
<i>Aristida ramosa</i>	2	38	2	5		P
<i>Astroloma humifusum</i>	2	25	1	5		P
<i>Austrostipa mollis</i>	2	17	2	<1		P
<i>Brachyloma daphnoides</i>	2	67	1	16		P
<i>Cheilanthes sieberi</i>	1	23	1	9		P
<i>Daviesia leptophylla</i>	2	23	1	5		P

<i>Dianella revoluta</i>	2	69	1	22		P
<i>Dillwynia sericea</i>	1	29	1	4		P
<i>Entolasia stricta</i>	2	27	2	4		P
<i>Eucalyptus dives</i>	3	52	3	18		P
<i>Eucalyptus macrorhyncha</i>	3	38	3	16		P
<i>Eucalyptus mannifera</i>	3	65	3	10		P
<i>Eucalyptus rossii</i>	3	60	3	7		P
<i>Gonocarpus tetragynus</i>	2	85	2	47		P
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	2	94	2	15		P
<i>Hibbertia obtusifolia</i>	2	63	1	34		P
<i>Hovea heterophylla</i>	2	31	1	4		P
<i>Kunzea ericoides</i>	2	25	2	4		P
<i>Laxmannia gracilis</i>	1	21	1	<1		P
<i>Lepidosperma gunnii</i>	2	50	1	4		P
<i>Leucopogon virgatus</i>	2	17	1	3		P
<i>Lissanthe strigosa</i>	2	29	1	7		P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	67	2	18		P
<i>Lomandra multiflora</i>	2	58	1	18		P
<i>Lomandra obliqua</i>	1	21	2	3		P
<i>Melichrus urceolatus</i>	1	71	1	12		P
<i>Microlaena stipoides</i>	2	77	2	34		P
<i>Opercularia diphylla</i>	2	38	2	3		P
<i>Patersonia sericea</i> var. <i>sericea</i>	2	25	1	3		P
<i>Persoonia linearis</i>	1	52	1	10		P
<i>Rhytidisporum procumbens</i>	2	23	1	3		P
<i>Rytidosperma pallidum</i>	3	54	2	17		P
<i>Rytidosperma</i> spp.	2	25	1	7		P
<i>Tricoryne elatior</i>	2	21	1	4		P
<i>Hypericum gramineum</i>	1	42	1	25		C
<i>Lomandra longifolia</i>	2	42	2	42		C
<i>Poa sieberiana</i>	2	46	2	48		C

Threatened communities: Nil.

Equivalent vegetation types: This community represents Community DSFp9 [*Tableland Low Woodland*] (Tozer et al. 2010) in the context of the upper Murrumbidgee catchment, based on an overlapping but different study area with additional field samples. There is no equivalent community in the classifications of Gellie (2005) as most of the plots in this group are recent samples from private land.

Frequently occurring weeds: Weed species are uncommon and their abundance is low in this community. The ubiquitous *Hypochaeris radicata* (0.29) is the most frequently recorded species.

Threats: Frequent and high-intensity grazing, such as occurs in areas of rural-residential subdivision, threatens remnants of this community. Of particular concern is the disruption this causes to important ecological processes such as seed production and seedling establishment, which may ultimately lead to structural and compositional changes including local extinctions of sensitive plant species. Firewood collection is also likely to represent a threat to components of this community.

Reservation status: Recorded from Tarlo River NP, Belmont SCA, Nadgigomar NR and Scott NR.

Extent of clearing: This type has probably experienced widespread but relatively low clearing levels, with clearing likely to have affected lower hills and the lower edges of patches. Future clearing pressure on remaining examples is most likely in areas of rural-residential subdivision around larger towns.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

p10: Black She-oak – Silvertop Ash tall shrubby dry sclerophyll open forest primarily in the Bungonia subregion of the South Eastern Highlands bioregion

Scientific Name: *Allocasuarina littoralis* – *Eucalyptus sieberi* – *Eucalyptus agglomerata* / *Persoonia linearis* – *Hibbertia obtusifolia* / *Goodenia hederacea* subsp. *hederacea* – *Lomandra obliqua* – *Microlaena stipoides* – *Pomax umbellata*

Number of samples: 53
 Richness [mean (±SD)]: 30 (9)
 Slope (degrees): (0) 3–10 (27)
 Altitude (m asl): (589) 663–789 (919)
 Ave. Annual Rainfall (mm): (695) 730–769 (866)
 Temp. Annual Range (°C): (23.5) 25.3–25.7 (26.3)

Vegetation Description: Community p10 is a dry tall open eucalypt forest with a canopy dominated by *Eucalyptus sieberi* and *Eucalyptus agglomerata*, usually with a sparse to dense small tree layer of *Allocasuarina littoralis* and scattered shrubs, including *Acacia terminalis* and *Persoonia linearis*. The groundlayer tends to be dominated by leaf litter, with a sparse scatter of grasses, sedges, forbs and low shrubs including *Billardiera scandens*, *Entolasia stricta*, *Goodenia hederacea* subsp. *hederacea*, *Hibbertia obtusifolia*, *Lepidosperma gunnii*, *Lomandra multiflora*, *Lomandra obliqua*, *Microlaena stipoides* and *Pomax umbellata*.

This community occurs on dry ridges and slopes, on soils of moderately low fertility derived predominantly from sedimentary and metasedimentary rocks of the Adaminaby, Lambie and Shoalhaven Groups and the Towrang and Gundry Beds, which are predominantly shales, sandstones, quartzites and conglomerates. It occurs from Greenwich Park and Chatsbury in the north, south to Larbert and Durran Durra, west to Collector and east beyond the study area boundary. While not sampled in the ACT, similar vegetation observed around Gibraltar Hill may be a western outlier or represent a variant of this community.

This community is often associated with other dry ridge forests across its range. It commonly occupies lower ridges and slopes of tableland hills, and may grade into Community p8 [*Silvertop Ash – Narrow-leaved Peppermint shrubby tall dry open forest*] on high stony tableland ridges, while on lower slopes it is often replaced by Community p9 [*Brittle Gum – Scribbly Gum shrubby tall dry open forest*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia obtusifolia</i>	2	15	2	1			P
<i>Acacia terminalis</i>	1	53	2	3			P
<i>Allocasuarina littoralis</i>	3	83	2	3			P
<i>Banksia spinulosa</i> var. <i>spinulosa</i>	2	17	2	2			P
<i>Billardiera scandens</i>	1	53	1	9			P
<i>Brachyloma daphnoides</i>	1	34	1	16			P
<i>Caustis flexuosa</i>	1	13	2	<1			P
<i>Daviesia leptophylla</i>	2	26	1	5			P
<i>Dianella revoluta</i>	1	43	1	22			P
<i>Entolasia stricta</i>	2	53	1	3			P
<i>Eucalyptus agglomerata</i>	3	64	3	2			P
<i>Eucalyptus globoidea</i>	3	25	3	2			P
<i>Eucalyptus rossii</i>	3	21	3	7			P
<i>Eucalyptus sieberi</i>	3	83	3	7			P
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	2	98	2	16			P
<i>Hakea dactyloides</i>	2	23	2	3			P
<i>Helichrysum leucopsidium</i>	2	19	1	<1			P
<i>Hibbertia empetrifolia</i>	2	17	2	<1			P
<i>Hibbertia obtusifolia</i>	1	77	1	34			P



Plate p10: An example of Community p10 near Tiyces Lane, Towrang, with a canopy dominated by *Eucalyptus sieberi*, a very sparse understorey and groundcover dominated by leaf litter.

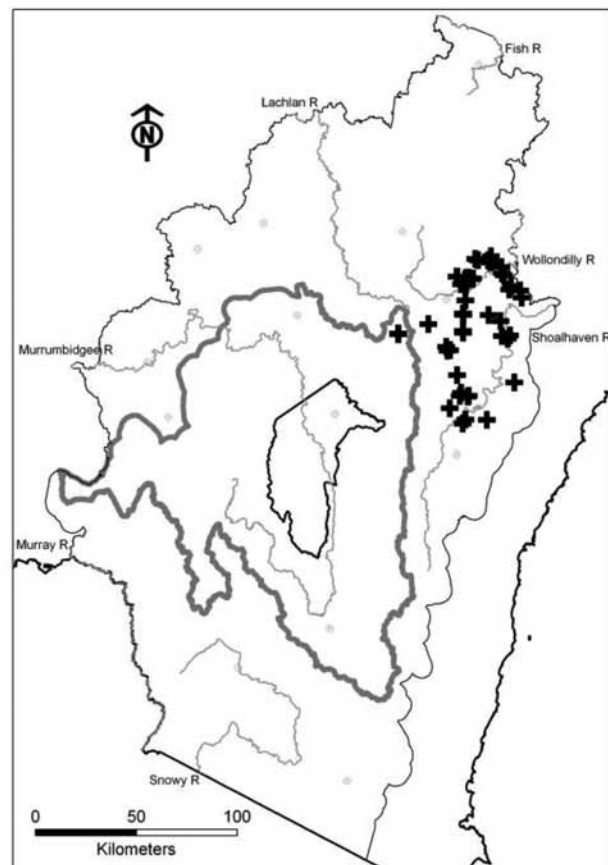


Fig. p10: Distribution of field samples assigned to this community.

<i>Lepidosperma gunnii</i>	1	55	1	4	P
<i>Lepidosperma urophorum</i>	2	15	2	1	P
<i>Lomandra glauca</i>	1	23	2	4	P
<i>Lomandra multiflora</i>	1	51	1	18	P
<i>Lomandra obliqua</i>	2	70	2	2	P
<i>Lomatia ilicifolia</i>	2	30	1	3	P
<i>Melichrus urceolatus</i>	1	43	1	13	P
<i>Microlaena stipoides</i>	2	57	2	34	P
<i>Monotoca scoparia</i>	1	32	1	15	P
<i>Opercularia aspera</i>	1	19	1	3	P
<i>Opercularia diphylla</i>	2	21	2	3	P
<i>Patersonia glabrata</i>	2	28	2	1	P
<i>Patersonia sericea</i> var. <i>longifolia</i>	2	23	2	<1	P
<i>Patersonia sericea</i> var. <i>sericea</i>	1	38	2	3	P
<i>Persoonia linearis</i>	1	92	1	9	P
<i>Persoonia mollis</i> subsp. <i>livens</i>	1	13	1	1	P
<i>Platysace ericoides</i>	2	30	2	<1	P
<i>Platysace lanceolata</i>	2	25	2	5	P
<i>Podolobium ilicifolium</i>	1	26	2	3	P
<i>Pomax umbellata</i>	1	66	2	4	P
<i>Rhytidosporum procumbens</i>	1	49	1	2	P
<i>Rytidosperma pallidum</i>	2	40	2	17	P
<i>Stryandra glauca</i>	2	49	2	5	P
<i>Xanthorrhoea concava</i>	2	30	2	<1	P
<i>Gonocarpus tetragynus</i>	2	45	2	48	C

Threatened communities: Nil.

Equivalent vegetation types: Community p10 represents a slight westward extension of Community DSFp10 [*Eastern Tablelands Dry Forest*] identified by Tozer et al. (2010), with the addition of new plots from Collector and recently acquired reserves around Goulburn. This community extends beyond the current study area's eastern boundary. It has floristic affinities with VG15 [*North East Tableland Dry Shrub Forest*] of Gellie (2005).

Frequently occurring weeds: Because this community occurs on poor soils, weeds are infrequent. The ubiquitous *Hypochaeris glabra* (0.09) is the most frequently recorded weed species in this community.

Threats: This community is commonly found as remnant patches of woody vegetation on poor soils on hills and ridges in rural landscapes where communities of better soils have been cleared. Some of its original extent is likely to have been cleared, and most remnants on private land are likely to be subject to ongoing light grazing. Where this community occurs on public land, frequent hazard reduction burning has the potential to eliminate important structural elements, such as the *Allocasuarina littoralis* dominated midstorey.

Reservation status: This community is known to occur in Tarlo River NP, Cookbundoon NR, Pomaderris NR, Bungonia SCA, Morton NP (western edge) and Nadgigomar NR.

Extent of clearing: This community is only likely to have undergone minor clearing across its range, predominantly at the edges of patches where it adjoins areas of slightly deeper and/or more fertile soils.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

p14: Red Stringybark – Scribbly Gum – *Rytidosperma pallidum* tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion

Scientific Name: *Eucalyptus macrorhyncha* – *Eucalyptus rossii* ± *Eucalyptus mannifera* / *Hibbertia obtusifolia* – *Brachyloma daphnoides* – *Daviesia leptophylla* / *Rytidosperma pallidum* – *Gonocarpus tetragynus* – *Poa sieberiana*

Number of samples:	165
Richness [mean (±SD)]:	27 (8)
Slope (degrees):	(0) 5–16 (51)
Altitude (m asl):	(504) 703–856 (1157)
Ave. Annual Rainfall (mm):	(603) 712–790 (918)
Temp. Annual Range (°C):	(24.1) 25.8–26.6 (28.1)

Vegetation Description: Community p14 is a tall open eucalypt forest dominated by *Eucalyptus macrorhyncha* and *Eucalyptus rossii*, often with *Eucalyptus mannifera*, *Eucalyptus goniocalyx*, *Eucalyptus dives* or *Eucalyptus polyanthemus*. The shrub layer is patchy and generally includes *Hibbertia obtusifolia*, *Brachyloma daphnoides*, *Daviesia leptophylla*, *Acacia gunnii* and *Hovea linearis* and occasionally *Melichrus urceolatus*, *Monotoca scoparia*, *Persoonia rigida* and *Gompholobium huegellii*. The climbing or prostrate sub-shrub *Hardenbergia violacea* is often present. The groundlayer is also generally patchy and dominated by grasses such as *Rytidosperma pallidum* and *Poa sieberiana* and a variety of forbs including *Lomandra filiformis* subsp. *coriacea*, *Dianella revoluta*, *Lomandra multiflora*, *Gonocarpus tetragynus* and *Goodenia hederacea* subsp. *hederacea*.

This community is widely distributed, occurring within the Murrumbidgee catchment mostly in areas north of the Wee Jasper and Captains Flat areas to Oberon in the Central West catchment. It grades into communities such as Community m51 [*Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll open forest on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan – Gourrock subregions of the South Eastern Highlands*] south of Queanbeyan, as well as Community p23 [*Red Stringybark – Broad-leaved Peppermint tall dry sclerophyll grassy open forest on loamy rises primarily in the Bungonia subregion of the South Eastern Highlands bioregion*] and Community p24 [*Yellow Box – Blakely's Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands bioregion*] on more gently undulating sites with loamy soils.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia buxifolia</i>	1	8	1	1			P
<i>Acacia decurrens</i>	1	6	2	1			P
<i>Acacia falciformis</i>	1	15	2	7			P
<i>Acacia genistifolia</i>	2	11	1	1			P
<i>Acacia gunnii</i>	1	44	1	4			P
<i>Acacia lanigera</i>	1	4	0	0			P
<i>Astrotricha ledifolia</i>	1	4	1	<1			P
<i>Brachyloma daphnoides</i>	2	62	1	14			P
<i>Caladenia carnea</i>	1	4	1	1			P
<i>Cassinia arcuata</i>	1	8	2	1			P
<i>Cheiranthra linearis</i>	1	13	1	<1			P
<i>Comesperma ericinum</i>	2	3	1	<1			P
<i>Daviesia leptophylla</i>	2	51	1	3			P
<i>Dianella revoluta</i>	1	63	1	20			P
<i>Dillwynia phyllicoides</i>	2	16	2	1			P
<i>Dillwynia sericea</i>	1	26	1	3			P
<i>Dillwynia sieberi</i>	1	4	1	<1			P

<i>Dillwynia</i> spp.	2	4	1	<1	P
<i>Diuris sulphurea</i>	1	5	1	1	P
<i>Drosera auriculata</i>	1	8	1	2	P
<i>Eucalyptus dives</i>	3	30	3	18	P
<i>Eucalyptus goniocalyx</i>	2	34	3	2	P
<i>Eucalyptus macrorhyncha</i>	3	86	3	12	P
<i>Eucalyptus mannifera</i>	3	51	2	9	P
<i>Eucalyptus polyanthemus</i>	3	22	3	2	P
<i>Eucalyptus praecox</i>	3	2	0	0	P
<i>Eucalyptus rossii</i>	3	66	3	4	P
<i>Genoplesium</i> spp.	1	4	1	<1	P
<i>Glossodia major</i>	1	3	1	<1	P
<i>Gompholobium huegelii</i>	1	20	1	4	P
<i>Gompholobium minus</i>	1	5	1	1	P
<i>Gonocarpus tetragynus</i>	2	84	2	46	P
<i>Goodenia bellidifolia</i>	2	8	2	1	P
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	2	67	2	15	P
<i>Hakea decurrens</i> subsp. <i>decurrens</i>	2	2	1	<1	P
<i>Hardenbergia violacea</i>	1	34	1	13	P
<i>Hibbertia calycina</i>	1	6	2	<1	P
<i>Hibbertia obtusifolia</i>	1	89	1	32	P
<i>Hibbertia riparia</i>	1	11	1	<1	P
<i>Hibbertia</i> spp.	1	4	1	<1	P
<i>Hovea heterophylla</i>	2	13	1	4	P
<i>Hovea linearis</i>	1	40	1	12	P
<i>Leptospermum multicaule</i>	2	5	2	<1	P
<i>Leucopogon virgatus</i>	1	15	1	3	P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	61	2	17	P
<i>Lomandra multiflora</i>	1	45	1	17	P
<i>Melichrus urceolatus</i>	1	37	1	12	P
<i>Monotoca scoparia</i>	1	31	1	14	P
<i>Olearia microphylla</i>	1	4	2	<1	P
<i>Patersonia sericea</i> var. <i>sericea</i>	1	9	2	3	P
<i>Persoonia rigida</i>	1	21	1	2	P
<i>Phyllanthus hirtellus</i>	1	8	1	1	P
<i>Poa sieberiana</i>	2	73	2	47	P
<i>Pomax umbellata</i>	1	12	2	5	P
<i>Pterostylis</i> spp.	1	19	1	5	P
<i>Pultenaea microphylla</i>	2	11	1	<1	P
<i>Pultenaea procumbens</i>	1	11	1	4	P
<i>Pultenaea subspicata</i>	1	7	2	2	P
<i>Rhytidisporum procumbens</i>	1	14	1	3	P
<i>Rytidosperma fulvum</i>	3	8	2	1	P
<i>Rytidosperma pallidum</i>	3	74	2	15	P
<i>Senecio tenuiflorus</i>	2	7	1	2	P
<i>Stypandra glauca</i>	1	17	2	5	P
<i>Styphelia triflora</i>	1	8	1	<1	P
<i>Tetratheca</i> spp.	1	2	1	<1	P
<i>Thelymitra</i> spp.	1	11	1	2	P
<i>Thysanotus patersonii</i>	1	5	1	<1	P
<i>Wahlenbergia gracilis</i>	2	12	1	6	P

Threatened communities: Nil.

Equivalent vegetation types: This community represents Community DSF p14 [Western Tablelands Dry Forest] as described by Tozer *et al.* (2010), with a western range extension into the upper Murrumbidgee catchment. The relationship between Community p14 and communities identified by Benson *et al.* (2010) with similar structural dominants outside the upper Murrumbidgee catchment (such as VCA 290, VCA 349 and VCA 351) requires resolution through further sampling and analysis.

Frequently occurring weeds: As with other communities occurring on soils of low fertility, weeds are an uncommon component of this community. *Hypochaeris glabra* (0.14), *Hypochaeris radicata* (0.29) are the most frequently recorded weeds, which is not surprising given the dispersive nature and colonising potential of these species.

Threats: This community is generally found on undulating terrain, and in close proximity to intensively managed farmland. As a consequence, moderate areas have been cleared and used for grazing. Where intensive



Plate p14: Community p14 with *Eucalyptus macrorhyncha*, *Eucalyptus mannifera*, *Eucalyptus rossii* and groundcover dominated by *Rhytidisperma pallidum*, above Soldiers Gully near Burra Burra Creek (plot RIC002LQ).

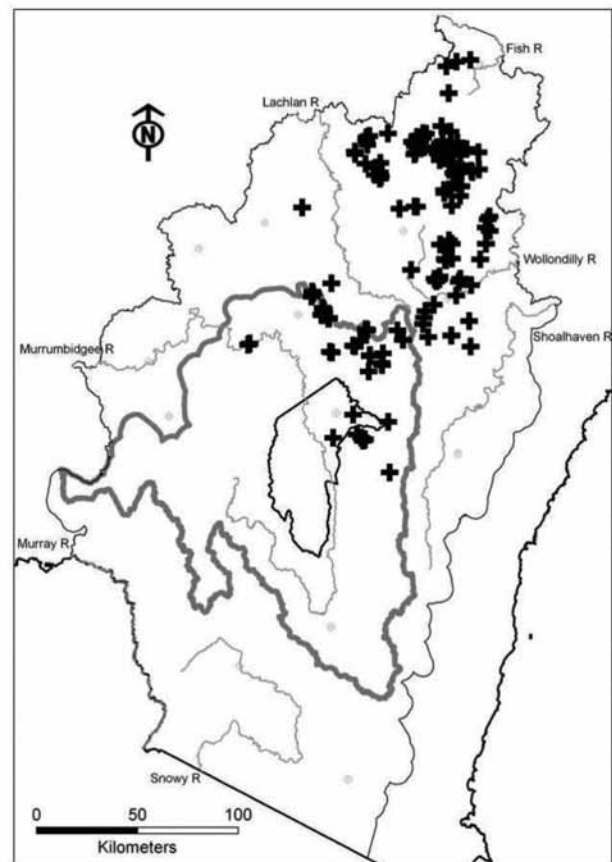


Fig. p14: Distribution of field samples assigned to this community.

grazing occurs, this has the potential to compromise community structure and species richness. On private property the collection of fallen timber for firewood is likely to be a threat to populations of ground-dwelling fauna.

Reservation status: Considered to be moderately well reserved. Examples of this community are found in Abercrombie River NP, Back Arm NR, Bango NR, Belmont SCA, Gillindich NR, Keverstone NP, McLeods Creek NR, Morton NP, Munday NR, Razorback NR, Tarlo River NP, Wee Jasper NR and Yanunubeyan NP.

Extent of clearing: Although this community generally occurs on nutrient deficient lithosols on low undulating hills, it is moderately cleared due to its broad extent and occurrence on gentle slopes.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

p23: Red Stringybark – Broad-leaved Peppermint tall dry sclerophyll grassy open forest on loamy rises primarily in the Bungonia subregion of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus macrorhyncha* – *Eucalyptus dives* / *Melichrus urceolatus* – *Hibbertia obtusifolia* – *Hardenbergia violacea* / *Microlaena stipoides* – *Lomandra filiformis* subsp. *coriacea* – *Hydrocotyle laxiflora* – *Gonocarpus tetragynus* – *Themeda australis* – *Poa sieberiana*

Number of samples:	86
Richness [mean (±SD)]:	36 (9)
Slope (degrees):	(0) 3–11 (37)
Altitude (m asl):	(531) 661–856 (1118)
Ave. Annual Rainfall (mm):	(664) 700–790 (940)
Temp. Annual Range (°C):	(24) 25.5–26.3 (28.3)

Vegetation Description: Community p23 is a tall open forest or woodland most commonly dominated by *Eucalyptus macrorhyncha* and *Eucalyptus dives*, often with a mix of other eucalypts including *Eucalyptus bridgesiana*, *Eucalyptus mannifera* and *Eucalyptus melliodora*. Taller shrubs are frequently absent, but some plots have a sparse small tree layer of acacias and a sparse to patchy shrub stratum. The groundlayer is commonly moderate to dense, with the most frequent taxa being *Lomandra filiformis* subsp. *coriacea* and a mix of grasses (e.g. *Microlaena stipoides*, *Themeda australis*, *Poa sieberiana*), low shrubs (*Hibbertia obtusifolia*, *Melichrus urceolatus*), and forbs (*Gonocarpus tetragynus*, *Goodenia hederacea* subsp. *hederacea*, *Hydrocotyle laxiflora*, *Hypericum gramineum* and *Oxalis perennans*).

This community occupies gently undulating to hilly country in the north-eastern Southern Tablelands, and is recorded from an area bounded by Tuena, Arkstone and Paling Yards in the north; Crooked Corner, Lost River, Bannister, Parkesbourne, Collector and Tarago in the southwest; and Larbert, Braidwood and Tomboye in the southeast. It extends to the east beyond the current study area boundary on similar undulating tableland country. Plots assigned to this type are commonly on sandy soils of intermediate depth and moderately low to low fertility derived from substrates including Adaminaby and Lambie Group sedimentary rocks and various granitic and acid volcanic rocks.

The floristic composition of Community p23 is intermediate between vegetation of drier hills with shallow soil, and vegetation of gentle

slopes and flats with deeper soils and better groundwater availability. On gentler slopes and flats this type may grade into p24 [*Yellow Box – Blakely's Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands bioregion*], while on steeper slopes with shallower soils it is generally replaced by dry sclerophyll forest types such as p9 [*Brittle Gum – Scribbly Gum shrubby tall dry open forest on infertile low ridges and hills primarily of the Bungonia subregion of the South Eastern Highlands bioregion*] or p14 [*Red Stringybark – Scribbly Gum – Rytidosperma pallidum tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion*]. The majority of plots allocated to this community are from private land subject to regular stock grazing, fencepost cutting and other disturbances, which may help to explain the highly variable shrub and canopy composition of this type.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia decurrens</i>	2	14	1	1			P
<i>Acacia genistifolia</i>	1	12	1	1			P
<i>Acaena echinata</i>	2	22	1	9			P
<i>Aristida jerichoensis</i> var. <i>jerichoensis</i>	2	13	2	<1			P
<i>Aristida ramosa</i>	2	29	2	5			P
<i>Astroloma humifusum</i>	1	22	1	5			P
<i>Austrostipa densiflora</i>	2	8	1	<1			P
<i>Austrostipa mollis</i>	3	7	2	<1			P
<i>Austrostipa rudis</i>	2	8	2	1			P
<i>Austrostipa scabra</i>	2	12	1	4			P
<i>Bossiaea buxifolia</i>	2	31	1	6			P
<i>Bossiaea prostrata</i>	2	20	1	2			P
<i>Cassinia arcuata</i>	1	8	1	1			P
<i>Cassinia laevis</i>	1	7	2	1			P
<i>Cheilanthes sieberi</i>	2	37	1	8			P
<i>Chrysocephalum apiculatum</i>	2	19	1	6			P
<i>Cymbonotus lawsonianus</i>	1	30	1	4			P
<i>Daviesia latifolia</i>	2	21	2	7			P
<i>Dianella longifolia</i>	1	9	1	3			P
<i>Dichelachne micrantha</i>	2	33	1	9			P
<i>Dillwynia sericea</i>	1	13	1	4			P
<i>Echinopogon caespitosus</i>	1	10	1	<1			P
<i>Einadia nutans</i>	1	17	1	4			P
<i>Elymus scaber</i>	2	35	1	21			P
<i>Eucalyptus blakelyi</i>	3	14	3	2			P
<i>Eucalyptus bridgesiana</i>	2	29	3	7			P
<i>Eucalyptus cinerea</i>	3	13	2	<1			P
<i>Eucalyptus dives</i>	3	56	3	17			P
<i>Eucalyptus macrorhyncha</i>	3	56	3	15			P
<i>Eucalyptus mannifera</i>	2	29	3	11			P
<i>Eucalyptus melliodora</i>	3	21	3	5			P
<i>Galium gaudichaudii</i>	2	22	1	9			P
<i>Geranium solanderi</i>	2	35	1	19			P
<i>Glycine microphylla</i>	2	7	2	1			P
<i>Gonocarpus tetragynus</i>	2	90	2	47			P
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	2	69	2	15			P
<i>Hardenbergia violacea</i>	2	42	1	14			P
<i>Hibbertia obtusifolia</i>	2	64	1	34			P
<i>Hovea heterophylla</i>	2	24	1	4			P
<i>Hydrocotyle laxiflora</i>	2	84	2	28			P
<i>Hypericum gramineum</i>	2	76	1	24			P
<i>Indigofera australis</i>	1	16	1	7			P
<i>Juncus filicaulis</i>	1	10	1	2			P
<i>Juncus subsecundus</i>	1	8	1	2			P
<i>Lagenophora gracilis</i>	2	9	1	1			P
<i>Laxmannia gracilis</i>	2	6	1	1			P
<i>Lissanthe strigosa</i>	2	38	1	6			P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	90	2	17			P
<i>Lomandra multiflora</i>	2	37	1	18			P

<i>Luzula densiflora</i>	1	22	1	5	P
<i>Melichrus urceolatus</i>	2	60	1	12	P
<i>Microlaena stipoides</i>	2	93	2	33	P
<i>Opercularia aspera</i>	2	16	1	3	P
<i>Opercularia diphylla</i>	2	23	2	3	P
<i>Opercularia hispida</i>	2	12	1	2	P
<i>Oxalis perennans</i>	2	70	1	12	P
<i>Ozothamnus diosmifolius</i>	1	7	1	<1	P
<i>Panicum effusum</i>	1	10	1	3	P
<i>Pimelea curviflora</i>	2	29	1	6	P
<i>Plantago gaudichaudii</i>	2	12	1	1	P
<i>Pterostylis</i> spp.	1	19	1	6	P
<i>Pultenaea microphylla</i>	2	9	1	1	P
<i>Rytidosperma laeve</i>	2	23	2	3	P
<i>Rytidosperma monticola</i>	2	6	2	1	P
<i>Rytidosperma racemosum</i>	2	44	2	10	P
<i>Rytidosperma tenuis</i>	2	10	2	<1	P
<i>Solenogyne dominii</i>	1	13	1	3	P
<i>Solenogyne gunnii</i>	2	13	1	5	P
<i>Thelymitra</i> spp.	1	10	1	2	P
<i>Themeda australis</i>	2	62	2	20	P
<i>Thysanotus patersonii</i>	2	10	1	<1	P
<i>Tricoryne elatior</i>	2	29	1	3	P
<i>Veronica plebeia</i>	2	34	1	5	P
<i>Wahlenbergia gracilis</i>	1	19	1	6	P
<i>Poa sieberiana</i>	2	57	2	48	C



Plate p23: Community p23 on “Arthursleigh”, west of Canyonleigh, with *Eucalyptus dives*, *Eucalyptus macrorhyncha* and a grazed grassy groundcover (plot CAN039LQ).

Threatened communities: Components of this community may be considered part of TSC Act 1995 – *White Box Yellow Box Blakely’s Red Gum Woodland* and EPBC Act 1999 – *White Box Yellow Box Blakely’s Red Gum Grassy Woodland and Derived Native Grassland*.

Equivalent vegetation types: This community represents Community GWp23 [*Tableland Hills Grassy Woodland*] (Tozer et al. 2010) in the context of this study, based on an overlapping but different study area with additional field samples from the tablelands and slopes.

Frequently occurring weeds: The weeds *Acetosella vulgaris* (0.35) and *Hypochaeris radicata* (0.61) are relatively common in this community, reflecting its proximity to land managed for grazing.

Threats: Frequent and high-intensity grazing, such as occurs in areas of rural-residential subdivision, threatens remnants of this community. Of particular concern is the disruption this causes to important ecological processes such as seed production and seedling establishment, which may ultimately lead to structural and compositional changes including local extinctions of sensitive plant species. Firewood collection is also likely to represent a threat to components of this community.

Reservation status: The distribution of this community generally corresponds with freehold land and this community is not well represented in the conservation reserve system. Small areas are present in the newer reserves of Gillindich NR, Mares Forest NP and Oakdale NR and immediately adjacent to Abercrombie River NP and Bungonia NP, none of which occur within the upper Murrumbidgee catchment.

Extent of clearing: This community has probably experienced widespread though only moderate levels of clearing, because it tends to occupy habitats of intermediate utility for agricultural development. Clearing is likely to have disproportionately affected examples on better soils, but also along the edges of patches on poorer soils. Future clearing pressure on remaining examples is most likely in areas of rural-residential subdivision around larger towns.

Reference: Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

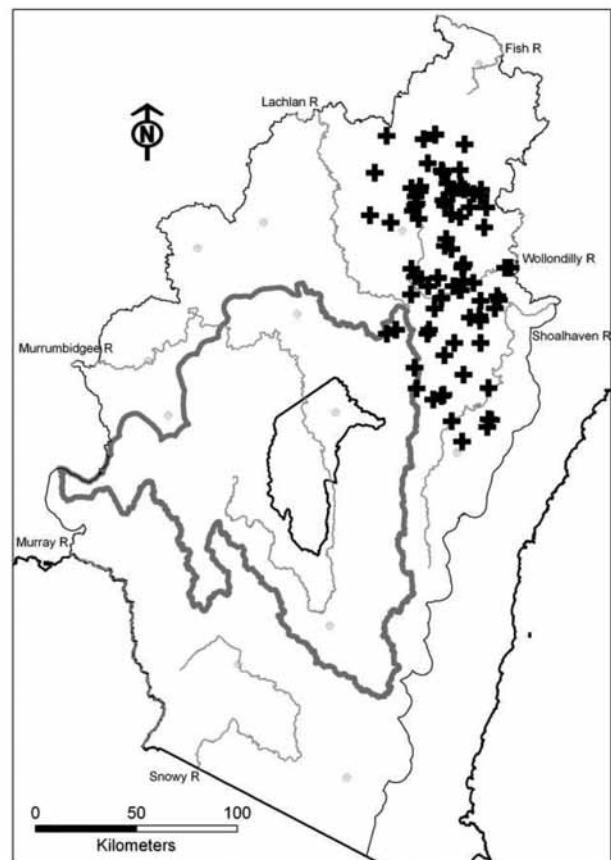


Fig. p23: Distribution of field samples assigned to this community.

u18: Mealy Bundy – Broad-leaved Peppermint shrubby mid-high open forest on granite substrates primarily in the Namadgi region

Scientific Name: *Eucalyptus nortonii* – *Eucalyptus dives* / *Cassinia longifolia* – *Hibbertia obtusifolia* – *Olearia tenuifolia* / *Gonocarpus tetragynus* – *Dichelachne micrantha* – *Wahlenbergia stricta* – *Hydrocotyle laxiflora*

Number of samples: 17
 Richness [mean (±SD)]: 26 (7)
 Slope (degrees): (8) 15–23 (35)
 Altitude (m asl): (730) 818–978 (1318)
 Ave. Annual Rainfall (mm): (735) 789–958 (1072)
 Temp. Annual Range (°C): (24.1) 25.5–26 (26.3)

Vegetation Description: Community u18 is a mid-high open forest dominated by *Eucalyptus nortonii* and *Eucalyptus dives*, with occasional occurrences of dense stands of *Callitris endlicheri* occurring in either the canopy or midstorey. The shrub layer is generally dense and may be dominated by taxa including *Cassinia longifolia*, *Olearia tenuifolia*, *Brachyloma daphnoides*, *Kunzea ericoides*, *Calytrix tetragona* and/or *Acacia falciformis*. The groundlayer is usually sparse and frequently includes the forbs *Gonocarpus tetragynus*, *Wahlenbergia stricta* and *Hydrocotyle laxiflora* and the low shrub *Hibbertia obtusifolia*. *Dichelachne micrantha* is the most common grass, with occasional occurrences of *Rytidosperma pallidum* and *Rytidosperma pilosum*.

This community was sampled in the ACT, primarily in Namadgi NP in the Mount Tennant area and slopes around Blue Gum Creek, however it may potentially occur in other parts of the Brindabella Ranges including in NSW on earthy sands derived from granite substrates. In Namadgi NP it grades into communities such as Community u150 [*Broad-leaved Peppermint – Mountain Gum tall grass-forb open forest of the South Eastern Highlands and Australian Alps bioregions*], Community u29 [*Apple Box – Broad-leaved Peppermint tall shrub-grass woodland primarily on granitoids of the South Eastern Highlands bioregion*], Community u66 [*Mealy Bundy – Red Stringybark grass-herb mid-high open forest of the South Eastern Highlands and Upper Slopes subregion of the South Western Slopes bioregion*] and Community u27 [*Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia falciformis</i>	3	41	2	7	P		
<i>Brachyloma daphnoides</i>	1	59	1	16	P		
<i>Bursaria spinosa</i>	2	35	1	10	P		
<i>Callitris endlicheri</i>	4	35	2	1	P		
<i>Calytrix tetragona</i>	3	47	2	<1	P		
<i>Cassinia longifolia</i>	3	100	1	16	P		
<i>Cheilanthes austrotenuifolia</i>	3	24	1	3	P		
<i>Dichelachne micrantha</i>	3	53	1	10	P		
<i>Dillwynia sericea</i>	2	24	1	4	P		
<i>Dodonaea viscosa</i>	3	24	1	2	P		
<i>Eucalyptus dives</i>	3	65	3	18	P		
<i>Eucalyptus nortonii</i>	3	100	3	3	P		
<i>Hibbertia obtusifolia</i>	2	76	1	34	P		
<i>Kunzea ericoides</i>	2	53	2	4	P		
<i>Leucopogon attenuatus</i>	2	29	1	1	P		
<i>Olearia tenuifolia</i>	2	65	1	<1	P		
<i>Oxalis exilis</i>	2	35	1	5	P		
<i>Pomax umbellata</i>	3	35	2	5	P		
<i>Pultenaea procumbens</i>	1	35	1	4	P		
<i>Senecio quadridentatus</i>	1	29	1	6	P		
<i>Stypandra glauca</i>	2	29	2	5	P		
<i>Thysanotus tuberosus</i>	1	41	1	3	P		



Plate u18: Community u18 showing *Eucalyptus nortonii* and shrubs including *Cassinia longifolia* and *Acacia dealbata*, with the ground layer covered with leaf litter. Bluegum Ck., Namadgi NP.

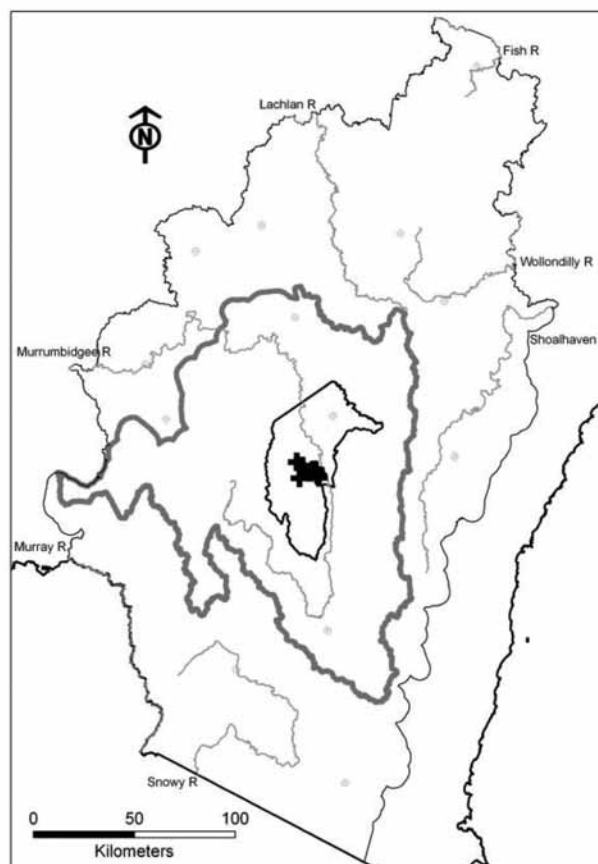


Fig. u18: Distribution of field samples assigned to this community.

<i>Wahlenbergia stricta</i>	2	65	1	18	P
<i>Dianella revoluta</i>	2	41	1	22	C
<i>Glycine clandestina</i>	1	59	1	29	C
<i>Gonocarpus tetragynus</i>	2	71	2	48	C
<i>Hydrocotyle laxiflora</i>	2	53	2	30	C
<i>Hypericum gramineum</i>	1	53	1	25	C
<i>Lomandra longifolia</i>	1	53	2	42	C

Threatened communities: Nil.

Equivalent vegetation types: This community has affinities with Community VG79 [*Montane Dry Shrub/Tussock Grass Forest*] (Gellie (2005).

Frequently occurring weeds: This community is largely confined to the conservation reserve system and has not experienced significant weed invasion. The weeds *Hypochaeris glabra* (0.41) and *Hypochaeris radicata* (0.76) are common, although not abundant within this community.

Threats: This community appears to be well reserved within the ACT, and is unlikely to have been significantly cleared in the past. Given the tenure on which it occurs, future significant clearing is unlikely. Minor threats include herbaceous weed invasion and grazing by feral goats.

Reservation status: All known examples of this community occur in Namadgi NP, however there may be other examples on unsampled private land in surrounding areas.

Extent of clearing: Given its landscape position and its high reservation status, clearing rates in this plant community are likely to be low.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u21: Broad-leaved Peppermint – Candlebark tall dry sclerophyll open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps bioregions

Scientific Name: *Eucalyptus dives* – *Eucalyptus rubida* / *Acacia dealbata* / *Hibbertia obtusifolia* – *Brachyloma daphnoides* – *Bossiaea buxifolia* / *Rytidosperma pallidum* – *Gonocarpus tetragynus* – *Poa sieberiana*

Number of samples:	45
Richness [mean (±SD)]:	33 (9)
Slope (degrees):	(2) 8–14 (29)
Altitude (m asl):	(745) 909–1074 (1189)
Ave. Annual Rainfall (mm):	(574) 667–764 (900)
Temp. Annual Range (°C):	(24.5) 25.5–26.2 (26.6)

Vegetation Description: Community u21 is a tall eucalypt woodland to open forest to woodland, with a canopy dominated by *Eucalyptus dives* and/or *Eucalyptus rubida*, often with *Eucalyptus bridgesiana* co-occurring. *Eucalyptus rubida* tends to be the most prevalent tree species in this community in the ACT. There may be a scattered to patchy stratum of tall shrubs, commonly including *Acacia dealbata*, *Cassinia longifolia* and/or *Acacia rubida*. A sparse groundlayer is dominated by a mix of low shrubs such as *Hibbertia obtusifolia*, *Brachyloma daphnoides*, *Bossiaea buxifolia*, *Pultenaea procumbens* and *Melichrus urceolatus*, forbs including *Gonocarpus tetragynus*, *Dianella revoluta*, *Hypericum gramineum*, and *Lomandra longifolia* and tussock grasses such as *Rytidosperma pallidum* and *Poa sieberiana*.

This community is widely distributed in the higher parts of the South East Corner bioregion and lower slopes of the Australian Alps bioregion. In the east, it occurs from Captains Flat south through Tinderry, Strike-a-Light and Mount Dowling NRs to Numeralla and Sunny Corner. The community is absent from the southern Monaro basalts but reappears

on the ranges in the far south from Merriangaah and Tombong, west to Byadbo and the Suggan Buggan Range. In the north-west, plots run from northeast Namadgi NP (lower slopes of Booroomba Creek) south along Boboyan Road to the lower slopes of Yaouk Bill Range and Murrumbucca.

Within this range, Community u21 generally occurs on broad ridge crests and broad gentle slopes with moderately-low fertility soils of intermediate depth, with records primarily from Adaminaby Group and Yalmy Group sediments (sandstones, mudstones, shales) and from granites and granodiorites (including Shannons Flat Suite, Clear Range Suite and Glenbog Suite). In the east of its range, it may grade into Community m51 [*Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll open forest on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan – Gourock subregions of the South Eastern Highlands*] on shallower soils on dry, exposed north and west-facing slopes and ridges, while in sheltered gullies and on sheltered south-facing slopes it may be replaced by Community m31 [*Ribbon Gum – Snow Gum – Cassinia longifolia tall shrub-grass open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands bioregion*]. In the western part of its range it tends to grade into Community u29 [*Apple Box – Broad-leaved Peppermint tall shrub-grass woodland primarily on granitoids of the South Eastern Highlands bioregion*] on steep exposed slopes with shallower soil or Community u52 [*Ribbon Gum – Robertson’s Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and northern Australian Alps bioregions*] on moist sheltered slopes and gullies. In frost hollows at higher elevations it may be replaced by Community u27 [*Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acacia dealbata</i>	1	60	2	25	P
<i>Acacia gunnii</i>	1	22	1	6	P
<i>Acacia rubida</i>	2	36	1	6	P
<i>Astroloma humifusum</i>	1	24	1	5	P
<i>Bossiaea buxifolia</i>	1	64	1	6	P
<i>Brachyloma daphnoides</i>	1	73	1	16	P
<i>Cassinia longifolia</i>	1	62	1	16	P
<i>Dichelachne rara</i>	1	27	1	8	P
<i>Dillwynia sericea</i>	1	24	1	4	P
<i>Eucalyptus bridgesiana</i>	3	38	3	7	P
<i>Eucalyptus dives</i>	3	89	3	17	P
<i>Eucalyptus rubida</i>	3	82	3	8	P
<i>Galium gaudichaudii</i>	1	31	1	9	P
<i>Gonocarpus tetragynus</i>	2	80	2	47	P
<i>Hibbertia obtusifolia</i>	2	96	1	34	P
<i>Hovea heterophylla</i>	1	20	1	4	P
<i>Hovea linearis</i>	1	53	1	13	P
<i>Hypericum gramineum</i>	1	56	1	25	P
<i>Indigofera australis</i>	1	22	1	7	P
<i>Leucopogon fletcheri</i> subsp. <i>brevisepalus</i>	1	40	1	3	P
<i>Lomandra multiflora</i>	1	49	1	18	P
<i>Melichrus urceolatus</i>	1	58	1	12	P
<i>Mirbelia oxylobioides</i>	3	18	1	3	P
<i>Pimelea curviflora</i>	1	38	1	6	P
<i>Pultenaea procumbens</i>	2	53	1	4	P
<i>Rytidosperma pallidum</i>	2	84	2	17	P
<i>Rytidosperma</i> spp.	1	22	1	7	P
<i>Stackhousia monogyna</i>	1	36	1	12	P
<i>Wahlenbergia communis</i>	1	22	1	5	P
<i>Wahlenbergia</i> spp.	1	18	1	5	P
<i>Wahlenbergia stricta</i>	1	42	1	18	P
<i>Lomandra longifolia</i>	1	44	2	42	C
<i>Poa sieberiana</i>	1	60	2	48	C



Plate u21: Community u21 showing *Eucalyptus rubida* with patches of *Bursaria spinosa* and *Cassinia longifolia*, and regenerating eucalypts in open grassy patches. Southern end of Bushfords Flats, Mt. Tennent Fire Trail, Namadgi NP.

Threatened communities: Examples may be part of the TSC Act – *Tablelands Snow Gum*, *Black Sallee*, *Candlebark* and *Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions*.

Equivalent vegetation types: Community u21 has no directly equivalent community in the classification of Gellie (2005). Most of the plots defining this community were not classified by Gellie (2005), and the small number of common plots were assigned in that classification to either VG74 [*South Eastern Tablelands Dry Shrub/Grass/Herb Forest*] or VG75 [*Tablelands Shrub/Tussock Grass Forest*]. Other plots which defined VG74 and VG75 were assigned by the present study to related groups m31 and m51.

Frequently occurring weeds: Weeds do not feature prominently in this community, although the common pasture weeds *Centaureum erythraea* and *Hypochaeris radicata* are present in a high proportion of sites (0.43).

Threats: The habitat of this community is generally not attractive to agricultural development, and it is unlikely to have been widely cleared. Where this community occurs on freehold land, incidental clearing for firewood and fenceposts represents a minor threat, as does grazing by feral herbivores.

Reservation status: NSW reserves known to contain this type include Yanunubeyan SCA, Tinderry NR, Burnt School NR, Strike-a-Light NR, Yaouk NR, Numeralla NR, Kybeyan NR, Merriangah NR, Meringo NR, Quidong NR, and south-eastern Kosciuszko NP. Within the ACT, samples of this community are distributed through eastern Namadgi NP.

Extent of clearing: Where the community occurs on relatively fertile soil, it is likely that moderate levels of clearing have occurred for pastoral development.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

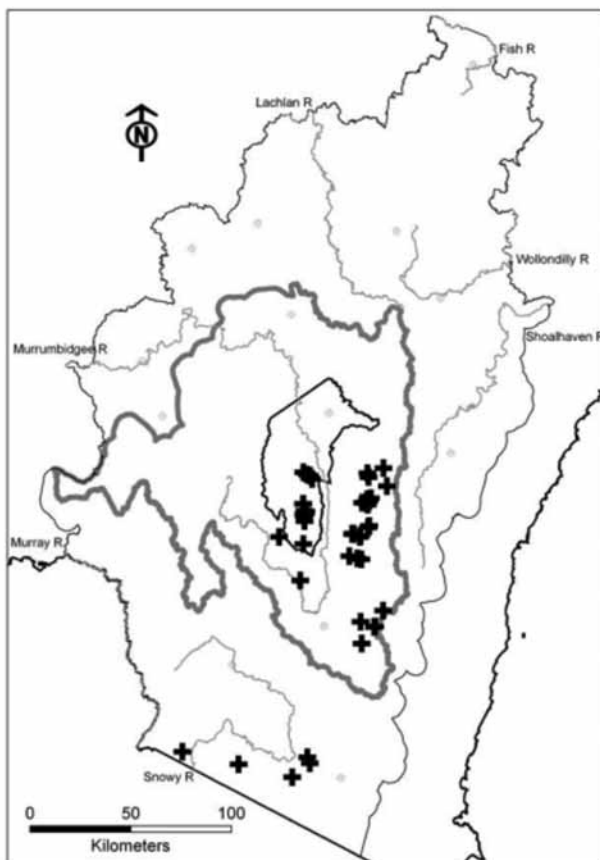


Fig. u21: Distribution of field samples assigned to this community.

u29: Apple Box – Broad-leaved Peppermint tall shrub-grass open forest primarily on granitoids of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus bridgesiana* – *Eucalyptus dives* ± *Eucalyptus nortonii* – *Eucalyptus melliodora* / *Bursaria spinosa* – *Cassinia longifolia* / *Elymus scaber* – *Poa sieberiana* – *Gonocarpus tetragynus*

Number of samples:	52
Richness [mean (±SD)]:	40 (9)
Slope (degrees):	(0) 12–23 (37)
Altitude (m asl):	(634) 765–961 (1257)
Ave. Annual Rainfall (mm):	(554) 663–778 (945)
Temp. Annual Range (°C):	(24.7) 25.8–26.7 (27.2)

Vegetation Description: Community u29 is a tall eucalypt woodland to open forest characterised by the presence of *Eucalyptus bridgesiana*, *Eucalyptus dives*, *Eucalyptus nortonii* and/or *Eucalyptus melliodora* on granite hills with a shrubby/grassy/herbaceous understorey. Shrub species include *Cassinia longifolia*, *Bursaria spinosa* and *Acacia dealbata*. The groundlayer is herbaceous with the main grass species being *Poa sieberiana*, *Elymus scaber* and *Themeda australis* and forbs including *Hydrocotyle laxiflora*, *Gonocarpus tetragynus*, *Glycine clandestina*, *Hypericum gramineum*, *Desmodium varians*, *Geranium solanderi*, *Galium gaudichaudii* and *Plantago varia*. The dominant tree species may vary from site to site.

This community occurs primarily on granitoids in eastern parts of the Namadgi region (e.g. Booth Range), extending southward to the Snowy Mountains in Kosciuszko NP, around Merriangah NR and Puapong, and east to Captains Flat. In the ACT and adjacent ranges it occurs in a

mosaic with Community u21 [*Broad-leaved Peppermint – Candlebark tall dry sclerophyll open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps bioregions*], and grades downslope into Community u27 [*Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia dealbata</i>	1	56	2		25		P
<i>Acaena ovina</i>	1	54	1		7		P
<i>Acrotriche serrulata</i>	1	37	1		11		P
<i>Ajuga australis</i>	1	21	1		8		P
<i>Asperula conferta</i>	1	42	1		10		P
<i>Asplenium flabellifolium</i>	1	29	1		8		P
<i>Austrostipa scabra</i>	2	13	1		4		P
<i>Bossiaea buxifolia</i>	1	21	1		7		P
<i>Bothriochloa macra</i>	1	27	1		3		P
<i>Brachyscome rigidula</i>	1	17	1		2		P
<i>Bursaria spinosa</i>	2	85	1		9		P
<i>Carex inversa</i>	1	46	1		8		P
<i>Cassinia longifolia</i>	3	81	1		15		P
<i>Cheilanthes sieberi</i>	2	40	1		8		P
<i>Chrysocephalum semipapposum</i>	1	17	1		4		P
<i>Clematis leptophylla</i>	2	17	1		1		P
<i>Crassula sieberiana</i>	1	33	1		5		P
<i>Cullen microcephalum</i>	1	19	1		2		P
<i>Cymbonotus lawsonianus</i>	1	15	1		5		P
<i>Cymbonotus</i> spp.	2	54	1		3		P
<i>Cynoglossum australe</i>	1	21	1		4		P
<i>Cynoglossum suaveolens</i>	1	13	1		3		P
<i>Daucus glochidiatus</i>	1	54	1		7		P
<i>Desmodium varians</i>	1	69	1		11		P
<i>Dichelachne micrantha</i>	1	37	1		9		P
<i>Dichelachne</i> spp.	1	19	1		2		P
<i>Dodonaea viscosa</i>	1	38	1		2		P
<i>Echinopogon cheelii</i>	1	13	1		<1		P
<i>Echinopogon</i> spp.	1	17	1		<1		P
<i>Elymus scaber</i>	3	87	1		20		P
<i>Epilobium billardierianum</i> subsp. <i>billardierianum</i>	1	13	1		2		P
<i>Eucalyptus bridgesiana</i>	3	62	3		6		P
<i>Eucalyptus dives</i>	3	42	3		18		P
<i>Eucalyptus melliodora</i>	3	31	3		5		P
<i>Eucalyptus nortonii</i>	3	38	3		3		P
<i>Euchiton sphaericus</i>	1	58	1		6		P
<i>Galium gaudichaudii</i>	1	63	1		9		P
<i>Geranium solanderi</i>	2	56	1		19		P
<i>Glycine clandestina</i>	2	81	1		29		P
<i>Gonocarpus tetragynus</i>	2	77	2		47		P
<i>Hydrocotyle laxiflora</i>	3	94	2		29		P
<i>Hypericum gramineum</i>	1	73	1		25		P
<i>Indigofera australis</i>	1	25	1		7		P
<i>Kunzea ericoides</i>	3	19	2		4		P
<i>Lepidosperma laterale</i>	1	37	1		9		P
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	1	56	1		15		P
<i>Luzula</i> spp.	1	37	1		6		P
<i>Panicum effusum</i>	1	23	1		3		P
<i>Pimelea curviflora</i>	1	19	1		6		P
<i>Plantago varia</i>	1	56	1		10		P
<i>Pleurosorus rutifolius</i>	1	15	1		<1		P
<i>Poa sieberiana</i>	3	90	2		47		P
<i>Rumex brownii</i>	1	37	1		9		P
<i>Rytidosperma penicillatum</i>	1	23	1		3		P
<i>Rytidosperma</i> spp.	2	23	1		7		P
<i>Schoenus apogon</i>	2	48	1		5		P
<i>Senecio quadridentatus</i>	1	23	1		5		P
<i>Solenogyne dominii</i>	1	17	1		3		P
<i>Solenogyne gunnii</i>	1	15	1		5		P



Plate u29: Community u29 with an open canopy of *Eucalyptus bridgesiana*, scattered *Cassinia longifolia* and a grassy understorey of *Austrostipa scabra* and *Panicum effusum*. Plot UMC136, north of Bullenamang Gap, Murrumbucca.

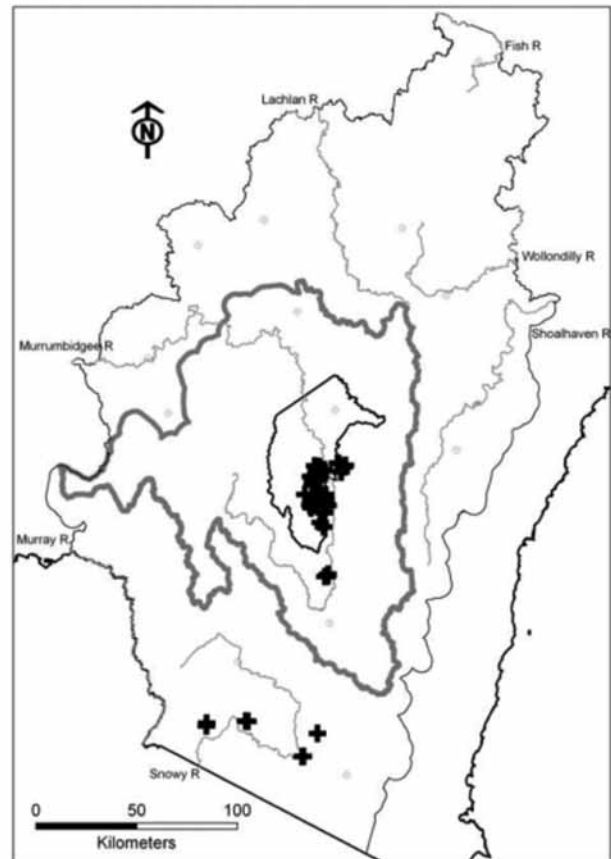


Fig. u29: Distribution of field samples assigned to this community.

<i>Sorghum leiocladum</i>	1	19	1	<1	P
<i>Themeda australis</i>	1	54	2	20	P
<i>Vittadinia cuneata</i>	1	23	1	2	P
<i>Vittadinia muelleri</i>	2	15	1	2	P
<i>Wahlenbergia communis</i>	1	52	1	4	P
<i>Wahlenbergia</i> spp.	1	17	1	5	P
<i>Wahlenbergia stricta</i>	2	48	1	18	P
<i>Hibbertia obtusifolia</i>	1	44	1	35	C
<i>Lomandra longifolia</i>	1	56	2	42	C

Threatened communities: Nil.

Equivalent vegetation types: Nil, although there are some affinities with VG81 [Eastern Dry Shrub/Herb/Grass Forest] identified by Gellie (2005).

Frequently occurring weeds: The diverse mix of weeds recorded within the community reflects its distribution over freehold grazing land. The most commonly recorded species are *Centaureum erythraea* (0.62), *Cirsium vulgare* (0.37), *Hypochaeris glabra* (0.25), *Hypochaeris radicata* (0.58), *Lysimachia arvensis* (0.35), *Oxalis corniculata* (0.5), *Petrorhagia nanteuillii* (0.33), *Rosa rubiginosa* (0.42), *Trifolium arvense* (0.63), *Trifolium campestre* (0.46), *Verbascum thapsus* subsp. *thapsus* (0.23).

Threats: Due to its distribution and landscape position, the main threat to this community is likely to be from selective timber removal and grazing by domestic and feral herbivores. Where grazing intensity is not carefully controlled, weed infestation may also occur.

Reservation status: Unknown, although examples of this community are found in Kosciuszko NP, Merriangaah NR, Namadgi NP and Stony Creek NR.

Extent of clearing: Likely to be minor as it occurs on poor soils on hills, although remnants on freehold land may be subject to selective tree removal for on-farm purposes.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u105: Broad-leaved Peppermint – Brittle Gum – Red Stringybark tall shrub-grass dry sclerophyll open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes bioregions

Scientific Name: *Eucalyptus dives* – *Eucalyptus macrorhyncha* – *Eucalyptus mannifera* / *Acacia rubida* / *Hibbertia obtusifolia* – *Platylobium montanum* – *Hardenbergia violacea* / *Poa sieberiana* – *Gonocarpus tetragynus* – *Lomandra longifolia*

Number of samples:	74
Richness [mean (±SD)]:	30 (10)
Slope (degrees):	(0) 11–24 (30)
Altitude (m asl):	(396) 647–861 (1078)
Ave. Annual Rainfall (mm):	(848) 996–1188 (1249)
Temp. Annual Range (°C):	(24.7) 25.2–27.1 (28.3)

Vegetation Description: Community u105 is a tall dry sclerophyll open forest dominated by *Eucalyptus dives*, *Eucalyptus mannifera* and *Eucalyptus macrorhyncha* with a sparse to patchy layer of shrubs including *Acacia rubida* and *Cassinia longifolia*. A diverse complement of low shrubs commonly includes *Hibbertia obtusifolia*, *Monotoca scoparia*, *Platylobium montanum* and/or *Persoonia chamaepeuce*. A groundlayer of tussock grasses, forbs and sprawling twiners, most frequently including *Rytidosperma pallidum*, *Poa sieberiana*, *Dianella*

revoluta, *Gonocarpus tetragynus*, *Hardenbergia violacea*, *Hovea linearis*, *Lomandra longifolia* and *Stylidium graminifolium sens. lat.* is typically present.

This community is commonly recorded from dry rocky ridges and exposed west-facing upper slopes with shallow soils of moderate to moderately low fertility derived from a wide variety of substrates including rhyolite, tuff, sandstone, shale, granite, granodiorite, psammite and conglomerate. Plots assigned to this type are closely tied to the Bondo subregion and are distributed around the northern and western rims of the Snowy Mountains, associated with lower foothill ranges, ridges of major valleys and outlying western ridgelines. Plots were recorded from Burrinjuck, Wee Jasper, the margins of the Brindabella Range, the Snubba Range from Weriboldera to Talbingo, east of Talbingo Reservoir on lower slopes above the Tumut River, on the southwestern lower slopes of the Kosciuszko massif from Jagumba Range to Khancoban, Geehi and Tom Groggin, and on outlying lower western ridgelines at Downfall, Carabost, Mundaroo and Tumbarumba. It may also occur in the Cotter River area of the ACT.

Community u105 grades into various communities across its range. In sheltered areas of deeper moister soil such as gullies and footslopes it may be replaced by Community u152 [Robertson's Peppermint – Red Stringybark very tall grass-forb sheltered open forest of the southwest South Eastern Highlands and upper South Western Slopes bioregions]. In the north of its range, at higher altitudes it may grade into Community u150 [Broad-leaved Peppermint – Mountain Gum tall grass-forb open forest of the South Eastern Highlands and Australian Alps bioregions], particularly in the Brindabella ranges, while at lower altitudes and decreasing rainfall from Burrinjuck east it may grade into Community p14 [Red Stringybark – Scribbly Gum – *Rytidosperma pallidum* tall grass–shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion]. To the west as rainfall declines and altitude falls, it is gradually replaced on lower ridgelines by Community u148 [Red Stringybark – Red Box grass-forb tall open forest of the upper South Western Slopes and western South Eastern Highlands bioregions].

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acacia buxifolia</i>	1	14	1	1	P
<i>Acacia gummii</i>	1	22	1	6	P
<i>Acacia rubida</i>	1	50	1	5	P
<i>Acacia ulicifolia</i>	1	9	1	2	P
<i>Acrotriche serrulata</i>	1	32	1	11	P
<i>Astrotricha ledifolia</i>	1	14	1	<1	P
<i>Austrostipa rudis</i>	1	22	2	3	P
<i>Billardiera scandens</i>	1	30	1	9	P
<i>Boronia nana</i>	1	6	1	<1	P
<i>Cassinia longifolia</i>	1	42	1	16	P
<i>Cassya pubescens</i>	1	19	1	2	P
<i>Cheiranthra linearis</i>	1	10	1	1	P
<i>Choretrum pauciflorum</i>	1	11	1	3	P
<i>Daviesia leptophylla</i>	1	20	1	5	P
<i>Dianella revoluta</i>	1	65	1	21	P
<i>Dichelachne sieberiana</i>	2	16	2	5	P
<i>Dillwynia phyllicoides</i>	2	22	2	2	P
<i>Eriochilus cucullatus</i>	1	9	1	<1	P
<i>Eucalyptus dives</i>	3	86	3	16	P
<i>Eucalyptus globulus</i> subsp. <i>bicostata</i>	1	8	3	<1	P
<i>Eucalyptus goniocalyx</i>	3	17	3	4	P
<i>Eucalyptus macrorhyncha</i>	3	76	3	14	P
<i>Eucalyptus mannifera</i>	3	72	3	10	P
<i>Eucalyptus nortonii</i>	2	15	3	3	P
<i>Eucalyptus radiata</i> subsp. <i>robertsonii</i>	1	22	3	9	P
<i>Gompholobium huegelii</i>	1	23	1	4	P
<i>Gonocarpus tetragynus</i>	1	89	2	47	P
<i>Grevillea lanigera</i>	1	16	1	3	P
<i>Grevillea ramosissima</i>	2	7	1	<1	P

<i>Hardenbergia violacea</i>	1	72	1	13	P
<i>Hibbertia obtusifolia</i>	1	93	1	33	P
<i>Hovea linearis</i>	1	57	1	12	P
<i>Indigofera australis</i>	1	31	1	6	P
<i>Lepidosperma laterale</i>	1	22	1	9	P
<i>Leptospermum brevipes</i>	1	7	2	<1	P
<i>Leucopogon attenuatus</i>	1	9	1	1	P
<i>Leucopogon fletcheri</i> subsp. <i>brevisepalus</i>	1	13	1	3	P
<i>Leucopogon virgatus</i>	1	17	1	3	P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	1	41	2	18	P
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	1	38	1	16	P
<i>Lomandra longifolia</i>	1	65	2	42	P
<i>Melichrus urceolatus</i>	1	25	1	13	P
<i>Monotoca scoparia</i>	1	58	1	14	P
<i>Omphacomeria acerba</i>	1	8	1	<1	P
<i>Persoonia chamaepeuce</i>	1	50	1	10	P
<i>Pimelea glauca</i>	1	6	1	<1	P
<i>Platylobium montanum</i>	2	65	2	9	P
<i>Poa sieberiana</i>	2	92	2	47	P
<i>Poa tenera</i>	3	10	2	2	P
<i>Pultenaea spinosa</i>	3	23	2	<1	P
<i>Rytidosperma pallidum</i>	2	53	2	17	P
<i>Stackhousia monogyna</i>	1	24	1	12	P
<i>Stylidium graminifolium sens. lat.</i>	1	65	1	24	P
<i>Tetradlea bauerifolia</i>	1	39	1	6	P
<i>Thelymitra pauciflora</i>	1	6	1	<1	P
<i>Xanthorrhoea glauca</i> subsp. <i>angustifolia</i>	2	6	2	<1	P

Threatened communities: Nil.

Equivalent vegetation types: This community is defined by a large number of field survey plots, including many plots from forested public lands which were classified by Gellie (2005). Strongly related Forest Ecosystems include VG110 [*Tablelands Dry Shrub/Grass Forest*] (23 plots in common), VG108 [*Western Tablelands Dry Herb/Grass Forest*] (15 plots in common) and VG109 [*Widespread Tablelands Dry Shrub/Tussock Grass Forest*] (5 plots in common). The relationship between Community u105 and communities identified by Benson *et al.* (2010) with similar structural dominants (such as VCA 351) requires resolution through further sampling and analysis.

Frequently occurring weeds: The common pasture weeds *Centaurium erythraea* (0.26) and *Hypochaeris radicata* (0.24) were the most frequently recorded weed species in this community.

Threats: This community is generally found on ridges and steep country which are generally not suitable for agriculture. As a consequence, it is unlikely to have been widely cleared. Examples on private land may be subject to occasional light rough-country grazing, selective tree removal and firewood collection.

Reservation status: Recorded from plots in Burrinjuck NR, Werboldera SCA, Brindabella NP and SCA, Bimberi NR, Downfall NR, Bogandyera NR and at numerous locations on the western edge of Kosciuszko NP.

Extent of clearing: Unlikely to have been widely cleared.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate u105: Community u105, beside Stony Creek firetrail in Werboldera SCA (near plot SWSWRB05) with *Eucalyptus dives* and *Eucalyptus mannifera* over a diverse layer of tough low shrubs, twines and grasses.

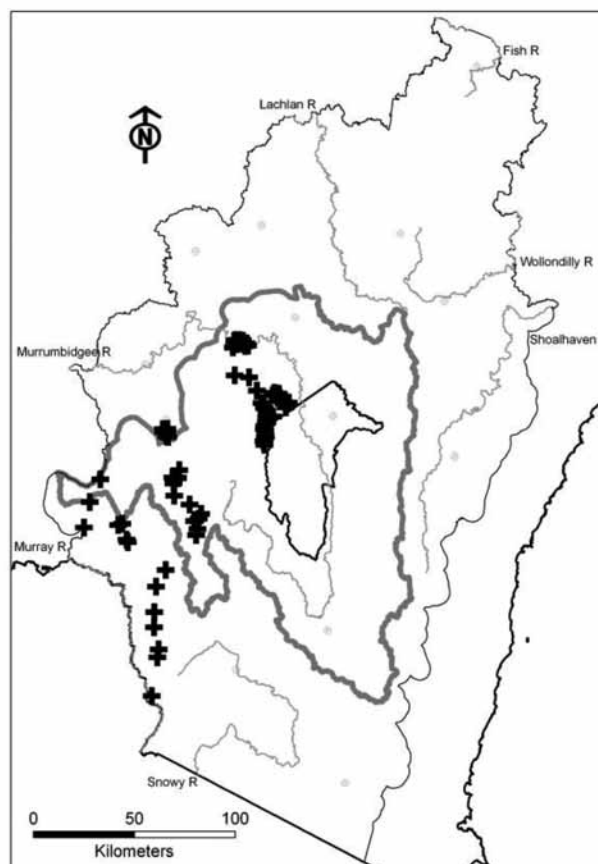


Fig. u105: Distribution of field samples assigned to this community.

u148: Red Stringybark – Red Box grass-forb tall open forest of the upper South Western Slopes and western South Eastern Highlands bioregions

Scientific Name: *Eucalyptus macrorhyncha* – *Eucalyptus polyanthemos* / *Hibbertia obtusifolia* / *Poa sieberiana* – *Gonocarpus tetragynus* – *Lomandra filiformis* **subsp. coriacea** – *Hydrocotyle laxiflora* – *Rytidosperma pilosum* – *Elymus scaber*

Number of samples:	64
Richness [mean (±SD)]:	32 (9)
Slope (degrees):	(1) 7–19 (30)
Altitude (m asl):	(293) 441–552 (837)
Ave. Annual Rainfall (mm):	(713) 846–961 (1201)
Temp. Annual Range (°C):	(25.5) 26.3–28.2 (28.8)

Vegetation Description: Community u148 is a tall eucalypt forest dominated by *Eucalyptus macrorhyncha* and *Eucalyptus polyanthemos*, occasionally with *Eucalyptus goniocalyx*, *Eucalyptus nortonii* or *Eucalyptus blakelyi*. The shrub layer ranges from sparse to dense, most frequently including *Brachyloma daphnoides*, *Xanthorrhoea glauca* subsp. *angustifolia* and the low shrub *Melichrus urceolatus* within a diverse suite of sclerophyllous shrub taxa occurring across the range of this community. The ground cover is open to dense and dominated by grasses such as *Poa sieberiana*, *Rytidosperma pilosum*, *Elymus scaber* and *Microlaena stipoides*, and forbs including *Gonocarpus tetragynus*, *Hydrocotyle laxiflora*, *Lomandra filiformis* subsp. *coriacea*, *Lomandra filiformis* subsp. *filiformis*, *Daucus glochidiatus* and *Wahlenbergia stricta*.

This community is widely distributed across the western half of the South Eastern Highlands and into the upper Slopes of the NSW South Western Slopes within the Murrumbidgee catchment. It occurs as far east as Yass, and westwards in a band through Tumut and southwards towards the Murray River. It grades into communities such as Community u19 [*Blakely's Red Gum – Yellow Box ± White Box tall grassy woodland of the Upper South Western Slopes and western South Eastern Highlands bioregions*] in more fertile areas, Community p14 [*Red Stringybark – Scribbly Gum – Rytidosperma pallidum tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion*] on poorer soils in the north-eastern extent of its range, and Community u105 [*Broad-leaved Peppermint – Brittle Gum – Red Stringybark tall shrub-grass dry sclerophyll open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes bioregions*] on poorer soils in the western extent of its range.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acacia buxifolia</i>	1	9	1	1	P
<i>Acacia implexa</i>	1	16	1	2	P
<i>Acacia ulicifolia</i>	2	19	1	1	P
<i>Bothriochloa macra</i>	2	11	1	3	P
<i>Brachychiton populneus</i>	1	17	1	2	P
<i>Brachyloma daphnoides</i>	2	36	1	16	P
<i>Brunonia australis</i>	2	20	1	<1	P
<i>Cassinia longifolia</i>	1	34	1	16	P
<i>Cheilanthes austrotenuifolia</i>	1	17	1	3	P
<i>Cheilanthes sieberi</i>	1	44	1	8	P
<i>Cheiranthra linearis</i>	1	22	1	<1	P
<i>Cynoglossum suaveolens</i>	1	11	1	3	P
<i>Daucus glochidiatus</i>	1	56	1	7	P
<i>Dichelachne crinita</i>	2	13	1	3	P
<i>Dichelachne hirtella</i>	2	16	1	1	P
<i>Dichelachne sieberiana</i>	2	30	2	5	P

<i>Dodonaea viscosa</i>	1	11	1	2	P
<i>Drosera auriculata</i>	1	22	1	2	P
<i>Elymus scaber</i>	2	53	1	20	P
<i>Eucalyptus albens</i>	3	9	3	<1	P
<i>Eucalyptus blakelyi</i>	2	25	3	2	P
<i>Eucalyptus goniocalyx</i>	3	41	3	3	P
<i>Eucalyptus macrorhyncha</i>	3	92	3	14	P
<i>Eucalyptus nortonii</i>	3	30	3	3	P
<i>Eucalyptus polyanthemos</i>	3	67	3	2	P
<i>Eucalyptus sideroxylon</i>	3	11	2	<1	P
<i>Geranium solanderi</i>	1	41	1	19	P
<i>Glycine clandestina</i>	1	52	1	29	P
<i>Gonocarpus tetragynus</i>	2	77	2	47	P
<i>Hibbertia obtusifolia</i>	1	67	1	34	P
<i>Hydrocotyle laxiflora</i>	2	64	2	29	P
<i>Hypericum gramineum</i>	1	45	1	25	P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	63	2	18	P
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	2	66	1	15	P
<i>Lomandra</i> spp.	2	11	1	<1	P
<i>Luzula densiflora</i>	1	31	1	5	P
<i>Melichrus urceolatus</i>	1	27	1	13	P
<i>Microtis unifolia</i>	1	25	1	4	P
<i>Oxalis perennans</i>	1	41	1	13	P
<i>Poa sieberiana</i>	2	72	2	48	P
<i>Pultenaea spinosa</i>	2	17	2	<1	P
<i>Rytidosperma pilosum</i>	2	56	2	8	P
<i>Scutellaria humilis</i>	1	17	1	1	P
<i>Senecio bathurstianus</i>	1	27	1	<1	P
<i>Senecio prenanthoides</i>	1	38	1	19	P
<i>Senecio quadridentatus</i>	1	17	1	5	P
<i>Senecio tenuiflorus</i>	1	20	1	2	P
<i>Stypandra glauca</i>	2	42	2	5	P
<i>Thelymitra</i> spp.	1	11	1	3	P
<i>Tricoryne elatior</i>	1	25	1	3	P
<i>Wahlenbergia stricta</i>	1	61	1	18	P
<i>Wurmbea dioica</i>	1	23	1	2	P
<i>Xanthorrhoea glauca</i> subsp. <i>angustifolia</i>	2	27	2	<1	P
<i>Microlaena stipoides</i>	2	47	2	34	C

Threatened communities: Nil.

Equivalent vegetation types: No clear equivalent, but has similarities with VG119 [*Western Tablelands Dry Shrub/Grass Forest*] defined by Gellie (2005). It also displays characteristics of VCA 290 [*Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass-shrub low open forest on hills in the southern part of the NSW South-western Slopes bioregion*] (Benson et al. 2010) and probably represents the more fertile end of this community.

Frequently occurring weeds: This community is characterised by an abundance of weed species, reflecting its distribution on freehold land, and the effect of domestic stock grazing on the groundlayer. The most commonly recorded weed species are *Aira elegantissima* (0.31), *Briza maxima* (0.86), *Briza minor* (0.45), *Cirsium vulgare* (0.31), *Hypericum perforatum* (0.37), *Hypochaeris glabra* (0.37), *Hypochaeris radicata* (0.55), *Lysimachia arvensis* (0.33), *Orobancha minor* (0.35), *Petrorhagia nanteuilii* (0.51), *Trifolium angustifolium* (0.45), *Trifolium arvense* (0.45) and *Trifolium campestre* (0.41).

Threats: The biggest threat to this community is weed infestation and grazing, which often occur in unison. Clearing is unlikely to represent a significant threat, although selective tree removal does occur, which may induce changes to structure and species composition.

Reservation status: Examples of this community are found in Bango NR, Bogandyera NR, Burrinjuck NR, Downfall NR, Ellerslie NR, Kosciuszko NP, Minjary NP, Mudjarn NR, Mulligans Flat NR, Muntoonen NR, Oak Creek NR, Tumblong SCA and Wereboldera SCA.



Plate u148: Community u148, in crown reserve above Lake Burrinjuck approximately 2.5km north of Taemas Bridge, plot UMC216.

Extent of clearing: Likely to be moderate.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u150: Broad-leaved Peppermint – Mountain Gum shrubby tall open forest of the South Eastern Highlands and Australian Alps bioregions

Scientific Name: *Eucalyptus dives* – *Eucalyptus dalrympleana* / *Acacia dealbata* / *Daviesia mimosoides* subsp. *mimosoides* – *Hibbertia obtusifolia* – *Monotoca scoparia* – *Persoonia chamaepeuce* – *Tetratheca bauerifolia* / *Lomandra longifolia* – *Gonocarpus tetragynus* – *Poa sieberiana*

Number of samples:	73
Richness [mean (±SD)]:	24 (6)
Slope (degrees):	(1) 6–17 (37)
Altitude (m asl):	(826) 1072–1230 (1490)
Ave. Annual Rainfall (mm):	(690) 870–1054 (1181)
Temp. Annual Range (°C):	(23.1) 24.3–25.2 (25.6)

Vegetation Description: Community u150 is a shrubby tall dry open forest dominated by *Eucalyptus dives* and *Eucalyptus dalrympleana*. The well defined midstorey typically includes *Monotoca scoparia*, *Daviesia mimosoides* subsp. *mimosoides* and *Acacia dealbata*. Shorter shrubs often include *Hibbertia obtusifolia*, *Persoonia chamaepeuce*, *Tetratheca bauerifolia* and *Brachyloma daphnoides*. The sparse groundlayer generally includes *Lomandra longifolia*, *Gonocarpus tetragynus*, *Styliidium graminifolium sens. lat.*, *Poa sieberiana*, *Dianella revoluta*, *Goodenia hederacea* subsp. *hederacea*, *Hovea linearis*, *Rytidosperma pallidum*, *Poranthera microphylla* and *Stellaria pungens*.

This is a widespread community, occurring from Tallaganda NP and Kybean SCA in the eastern part of the study area, through Tinderry NR, Namadgi NP to Brindabella NP in the west. It is most common on metasedimentary and granite geologies, usually on lower slopes. This community often forms a mosaic with other dry montane forests and subalpine woodlands including Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*], Community u52 [*Ribbon Gum – Robertson’s Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and northern Australian Alps bioregions*] and, in the south of the study area, Community m31 [*Ribbon Gum – Snow Gum – Cassinia longifolia tall shrub-grass open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands bioregion*].

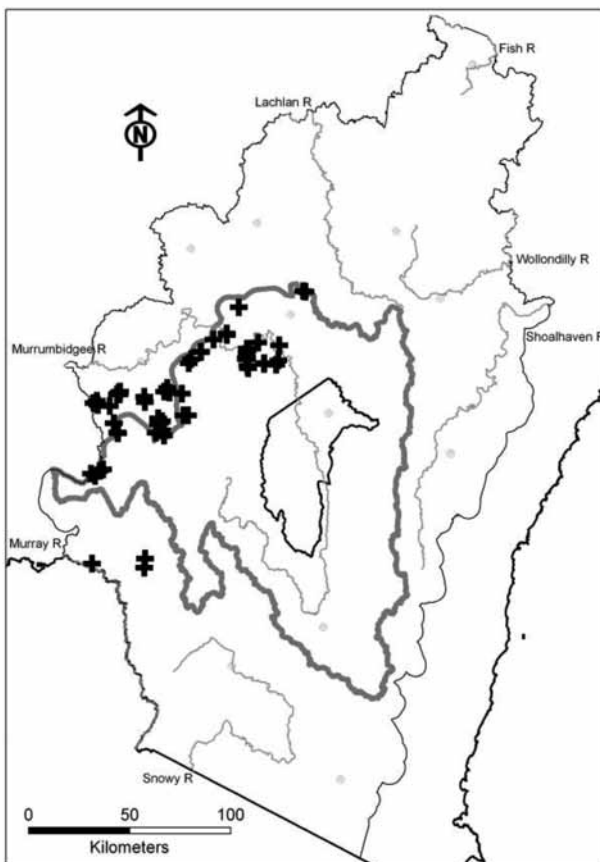


Fig. u148: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia gunnii</i>	1	19	1	6			P
<i>Acrotriche serrulata</i>	1	25	1	11			P
<i>Brachyloma daphnoides</i>	1	49	1	16			P
<i>Cassytha pubescens</i>	1	8	1	2			P
<i>Choretrum pauciflorum</i>	1	25	1	2			P
<i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>	3	68	2	8			P
<i>Daviesia ulicifolia</i>	2	29	2	10			P
<i>Deyeuxia quadriseta</i>	1	19	1	4			P
<i>Dianella revoluta</i>	1	51	1	22			P
<i>Eucalyptus dalrympleana</i>	3	67	3	19			P
<i>Eucalyptus dives</i>	3	85	3	17			P
<i>Eucalyptus radiata</i> subsp. <i>robertsonii</i>	3	21	3	9			P
<i>Eucalyptus rubida</i>	3	25	3	8			P
<i>Exocarpos strictus</i>	1	30	1	12			P
<i>Gonocarpus tetragynus</i>	2	77	2	47			P
<i>Grevillea lanigera</i>	1	15	1	3			P
<i>Hibbertia obtusifolia</i>	2	93	1	33			P
<i>Hovea linearis</i>	1	48	1	12			P
<i>Lomandra longifolia</i>	2	92	2	41			P
<i>Monotoca scoparia</i>	2	79	1	13			P
<i>Oxylobium ellipticum</i>	1	16	1	4			P
<i>Persoonia chamaepeuce</i>	1	63	1	10			P
<i>Persoonia silvatica</i>	1	11	1	3			P
<i>Pimelea linifolia</i>	1	19	1	8			P
<i>Poa sieberiana</i>	2	70	2	48			P
<i>Stylidium graminifolium sens. lat.</i>	1	71	1	24			P
<i>Tetratheca bauerifolia</i>	2	55	1	6			P
<i>Veronica perfoliata</i>	1	22	1	4			P
<i>Acacia dealbata</i>	2	41	2	26			C

Threatened communities: Nil.

Equivalent vegetation types: Amalgamates VG103 [Western Montane Dry Fern/Grass Forest], VG105 [ACT Montane Dry Shrub Forest] and VG107 [Central Tableland/ACT Montane Dry Shrub Forest], which are very closely related Vegetation Groups previously described by Gellie (2005).

Frequently occurring weeds: The low abundance of weed species reflects the landuse history and current tenure of this community. Only the most dispersive and widespread weed species were recorded, such as *Centaurium erythraea* (0.08) and *Hypochaeris radicata* (0.17).

Threats: Frequent and intense fire has the potential to affect the structural and floristic integrity of this vegetation community. The naturally open midstorey and canopy may make this community attractive to grazing by feral herbivores.

Reservation status: Likely to be reasonably well reserved; most of the plots assigned to this community were located in conservation reserves, including Namadgi NP, Bimberi NR, Bondi Gulf NR, Brindabella NP and SCA, Dangelong NR, Nimmo NR, Scabby Range NR, Tallaganda NP, Tinderry NR, Yanununbeyan NP and Yaouk NR.

Extent of clearing: Not assessed, but likely to be minimal.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate u150: Community u150 dominated by *Eucalyptus dalrympleana* with sparse *Eucalyptus pauciflora* and a shrubby understorey of *Daviesia mimosoides*. Coolumbooka NR near Bombala.

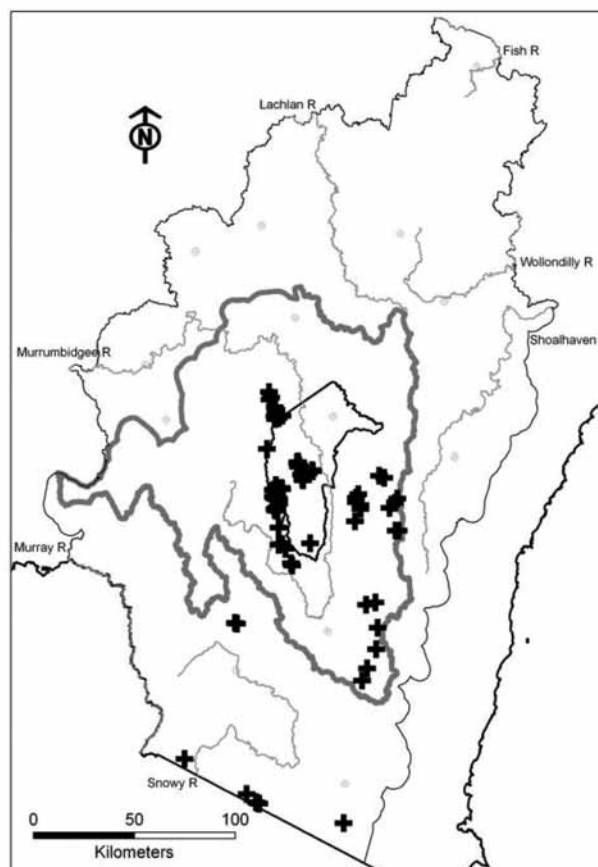


Fig. u150: Distribution of field samples assigned to this community.

**u152: Robertson's Peppermint – Red Stringybark
very tall grass-forb sheltered open forest of the
southwest South Eastern Highlands and upper
South Western Slopes bioregions**

Scientific Name: *Eucalyptus radiata* subsp. *robertsonii*
– *Eucalyptus macrorhyncha* / *Acacia dealbata* / *Pteridium*
esculentum – *Hibbertia obtusifolia* / *Poa sieberiana* –
Microlaena stipoides – *Hydrocotyle laxiflora* – *Gonocarpus*
tetragynus – *Geranium solanderi* – *Acaena novae-zelandiae*

Number of samples: 101
Richness [mean (±SD)]: 44 (12)
Slope (degrees): (1) 5–17 (38)
Altitude (m asl): (309) 619–817 (1085)
Ave. Annual Rainfall (mm): (825) 963–1177 (1312)
Temp. Annual Range (°C): (24.5) 25.8–27.5 (28.6)

Vegetation Description: Community u152 is a very tall open eucalypt forest with canopy commonly dominated by *Eucalyptus radiata* subsp. *robertsonii* and *Eucalyptus macrorhyncha*, less frequently with *Eucalyptus bridgesiana*, *Eucalyptus dives* or *Eucalyptus viminalis*. Patches within this community may be dominated by *Eucalyptus globulus* subsp. *bicostata*. Plots assigned to this group commonly contains a sparse layer of scattered shrubs and small trees including *Acacia dealbata* and *Acacia melanoxylon*, with a patchy to continuous groundlayer of grasses including *Poa sieberiana*, *Microlaena stipoides*, *Elymus scaber* and *Themeda australis*, the fern *Pteridium esculentum* and a diverse mix of forbs including *Acaena novae-zelandiae*, *Dichondra repens*, *Euchiton japonicus*, *Geranium solanderi*, *Glycine clandestina*, *Gonocarpus tetragynus*, *Hydrocotyle laxiflora*, *Hypericum gramineum*, *Lomandra filiformis* subsp. *filiformis*, *Plantago varia*, *Senecio prenanthoides*, *Viola betonicifolia* and *Wahlenbergia stricta*. Low shrubs such as *Hibbertia obtusifolia* and *Platylobium montanum* are often present.

This community is found on moist sheltered slopes and gullies along lower western margins of the Snowy Mountains and further west on lower outlying ranges. It is commonly recorded from soils of intermediate fertility derived from a wide variety of substrates including granodiorite, granite, rhyolite, sandstone, tuff, psammite and shale. Plots are distributed around the northern and western rims of the Snowy Mountains, associated with lower foothills of the ranges and major valleys and outlying lower western ranges. Records occur from Burrinjuck and lower slopes of the Brindabellas in the north, west and south to Bungongo, Wee Jasper, Billaloola and Argalong; south along Snubba Range and lower slopes of the upper Goobarrangandra and Tumut Rivers; western footslopes of the Bago Range at Courabyra, Tumarumba and Maragle; to the far south along lower slopes of the upper Murray gorge to Khancoban and Tom Groggin; and on lower ranges to the west including Ellerslie, Downfall and Munderoo.

Community u152 generally occurs on more sheltered slopes and footslopes with somewhat deeper, moister soils than the related Community u105 [*Broad-leaved Peppermint – Brittle Gum – Red Stringybark tall shrub-grass dry sclerophyll open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes bioregions*]. At higher altitudes with cooler winters and increasing rainfall it may be replaced by Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*] or Community u52 [*Ribbon Gum – Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and northern Australian Alps bioregions*], while at lower elevations on the margins of undulating slopes country it may grade into Community u148 [*Red Stringybark – Red Box grass-forb tall open forest of the upper South Western Slopes and western South Eastern Highlands bioregions*] or Community u29 [*Apple Box – Broad-leaved Peppermint tall shrub-grass woodland primarily on granitoids of the South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia dealbata</i>	2	66	2	25			P
<i>Acacia melanoxylon</i>	1	42	1	13			P
<i>Acaena echinata</i>	1	49	1	8			P
<i>Acaena novae-zelandiae</i>	2	73	1	26			P
<i>Acaena ovina</i>	1	5	1	<1			P
<i>Acrotriche serrulata</i>	1	50	1	10			P
<i>Ajuga australis</i>	1	23	1	7			P
<i>Ammobium craspedioides</i>	2	5	1	<1			P
<i>Amyema pendulum</i>	1	13	1	2			P
<i>Asperula conferta</i>	1	29	1	10			P
<i>Asperula scoparia</i>	2	35	2	22			P
<i>Boronia nana</i>	1	9	1	<1			P
<i>Brunonia australis</i>	2	4	2	<1			P
<i>Bulbine bulbosa</i>	1	30	1	3			P
<i>Burchardia umbellata</i>	1	7	1	<1			P
<i>Caladenia carnea</i>	1	19	1	<1			P
<i>Carex breviculmis</i>	2	30	1	12			P
<i>Carex incomitata</i>	1	11	1	<1			P
<i>Cassinia aculeata</i>	1	29	1	13			P
<i>Cassinia longifolia</i>	1	38	1	16			P
<i>Cheilanthes austrotenuifolia</i>	1	11	1	3			P
<i>Chiloglottis trapeziformis</i>	1	6	1	<1			P
<i>Corybas</i> spp.	1	5	1	<1			P
<i>Cymbonotus preissianus</i>	2	47	1	5			P
<i>Cynoglossum suaveolens</i>	1	10	1	3			P
<i>Daucus glochidiatus</i>	1	26	1	8			P
<i>Desmodium varians</i>	1	32	1	12			P
<i>Dichelachne crinita</i>	1	10	1	3			P
<i>Dichelachne sieberiana</i>	2	19	2	5			P
<i>Dichondra repens</i>	2	54	2	20			P
<i>Dipodium roseum</i>	1	13	1	<1			P
<i>Diuris sulphurea</i>	1	7	1	1			P
<i>Drosera auriculata</i>	2	25	1	2			P
<i>Drosera</i> spp.	1	4	1	<1			P
<i>Echinopogon intermedius</i>	1	10	1	<1			P
<i>Echinopogon ovatus</i>	2	41	1	9			P
<i>Elymus scaber</i>	2	56	1	20			P
<i>Epilobium billardierianum</i> subsp. <i>cinereum</i>	1	28	1	4			P
<i>Eucalyptus bridgesiana</i>	3	37	3	6			P
<i>Eucalyptus dives</i>	2	34	3	18			P
<i>Eucalyptus globulus</i> subsp. <i>bicostata</i>	3	13	1	<1			P
<i>Eucalyptus macrorhyncha</i>	3	60	3	14			P
<i>Eucalyptus radiata</i> subsp. <i>robertsonii</i>	3	68	3	7			P
<i>Eucalyptus viminalis</i>	3	24	3	12			P
<i>Euchiton japonicus</i>	1	54	1	14			P
<i>Exocarpos cupressiformis</i>	1	20	1	3			P
<i>Galium ciliare</i>	1	5	2	<1			P
<i>Galium gaudichaudii</i>	1	26	1	9			P
<i>Galium leiocarpum</i>	1	12	1	4			P
<i>Geranium solanderi</i>	2	69	1	18			P
<i>Glossodia major</i>	2	4	1	<1			P
<i>Glycine clandestina</i>	1	82	1	28			P
<i>Gompholobium huegelii</i>	2	13	1	4			P
<i>Gonocarpus tetragynus</i>	2	81	2	47			P
<i>Grevillea rosmarinifolia</i>	1	5	1	<1			P
<i>Hardenbergia violacea</i>	1	26	1	14			P
<i>Hibbertia obtusifolia</i>	1	66	1	34			P
<i>Hovea linearis</i>	1	24	1	13			P
<i>Hydrocotyle laxiflora</i>	2	81	2	28			P
<i>Hypericum gramineum</i>	1	68	1	24			P
<i>Leptospermum continentale</i>	1	10	1	1			P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	38	2	18			P
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	1	59	1	15			P
<i>Luzula densiflora</i>	1	17	1	5			P
<i>Luzula flaccida</i>	1	47	1	12			P
<i>Mentha diemenica</i>	1	17	1	2			P
<i>Microlaena stipoides</i>	2	82	2	33			P



Plate u152: Community u152 on the footslope above Stony Creek, Werboldera SCA, with *Eucalyptus bridgesiana* and *Eucalyptus macrorhyncha* over a scattered low shrubs and a grassy groundcover.

<i>Microtis unifolia</i>	1	33	1	3	P
<i>Ophioglossum lusitanicum</i>	2	4	1	<1	P
<i>Oxalis exilis</i>	1	23	1	4	P
<i>Oxalis perennans</i>	1	25	1	13	P
<i>Oxalis radicata</i>	1	4	1	<1	P
<i>Pimelea curviflora</i>	1	19	1	6	P
<i>Plantago varia</i>	2	55	1	10	P
<i>Platylobium montanum</i>	2	53	2	9	P
<i>Poa helmsii</i>	1	11	2	3	P
<i>Poa sieberiana</i>	3	86	2	47	P
<i>Polygala japonica</i>	1	4	1	<1	P
<i>Pteridium esculentum</i>	2	68	2	26	P
<i>Pterostylis longifolia</i>	1	6	1	<1	P
<i>Pterostylis nutans</i>	1	14	1	<1	P
<i>Pterostylis pedunculata</i>	1	8	1	<1	P
<i>Pultenaea juniperina</i>	2	5	2	<1	P
<i>Pultenaea polifolia</i>	1	5	1	<1	P
<i>Ranunculus lappaceus</i>	1	34	1	10	P
<i>Ranunculus pachycarpus</i>	2	4	0	0	P
<i>Ranunculus scapiger</i>	2	10	1	1	P
<i>Ranunculus sessiliflorus</i>	2	5	1	<1	P
<i>Rytidosperma penicillatum</i>	2	11	1	3	P
<i>Rytidosperma pilosum</i>	2	34	2	8	P
<i>Rytidosperma racemosum</i>	2	28	2	10	P
<i>Scutellaria humilis</i>	1	15	1	1	P
<i>Senecio bathurstianus</i>	1	7	1	1	P
<i>Senecio diaschides</i>	2	23	1	5	P
<i>Senecio prenanthoides</i>	1	54	1	18	P
<i>Senecio tenuiflorus</i>	2	10	1	2	P
<i>Stackhousia monogyna</i>	1	35	1	12	P
<i>Thelymitra pauciflora</i>	1	5	1	<1	P
<i>Themeda australis</i>	2	52	2	20	P
<i>Thysanotus tuberosus</i>	1	14	1	3	P
<i>Veronica calycina</i>	1	45	1	15	P
<i>Viola betonicifolia</i>	2	65	1	26	P
<i>Wahlenbergia stricta</i>	1	52	1	18	P
<i>Wurmbea dioica</i>	1	25	1	2	P
<i>Stellaria pungens</i>	1	41	2	31	C

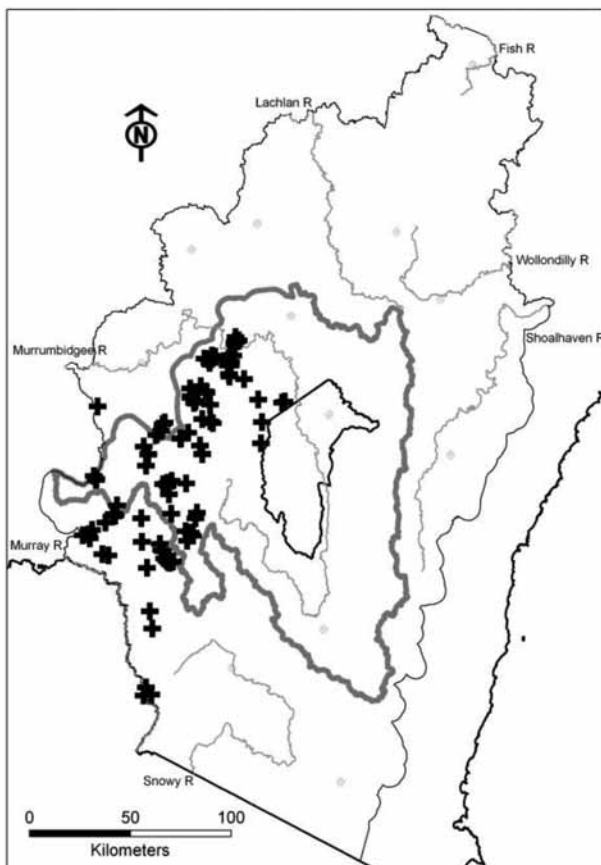


Fig. u152: Distribution of field samples assigned to this community.

Threatened communities: Nil.

Equivalent vegetation types: The most strongly related Forest Ecosystems of Gellie (2005) are VG93 [*Western Tablelands Herb/Grass Dry Forest*] (29 shared plots) and VG94 [*South West Slopes Acacia Dry Herb/Grass Forest*] (8 plots). Community u152 has affinities with VCA 295 [*Robertson’s Peppermint – Broad-leaved Peppermint – Norton’s Box – stringybark shrub-fern open forest of the NSW South Western Slopes and South Eastern Highlands bioregions*] (Benson et al. 2010).

Frequently occurring weeds: Although this community is most common on public land (State Forest and Conservation Reserve), its proximity to land used for domestic stock grazing is reflected in the weed species most commonly recorded. These include *Centaurium erythraea* (0.42), *Cirsium vulgare* (0.32), *Hypericum perforatum* (0.31), *Hypochaeris radicata* (0.78), *Rosa rubiginosa* (0.31) and *Hypericum perforatum* (0.30).

Threats: Most surveyed occurrences of this community are on slopes and foothills of steep country with relatively low suitability for agriculture, and these situations are unlikely to have been widely cleared. It is more likely that some clearing has occurred on the margins of private land where gentler footslopes were considered suitable for pasture development and grazing. Areas in State Forests may be subject to logging and to fire regimes associated with silvicultural management, which may modify vegetation structure and floristic composition over time. Surveyed examples have not been subject to widespread weed invasion, but areas subject to disturbance by grazing animals or vehicles, including logged forests, may be more prone to invasion by weeds. This community is found within the altitude and rainfall band preferred by *Hypericum perforatum* – >500m altitude and >600mm rainfall; Naughton & Bourke 2007) and may be prone to invasion by this weed.

Reservation status: Recorded from plots within Burrinjuck NR, Brindabella NP and SCA, Bimberi NR, Wereboldera SCA, Ellerslie NR, Downfall NR, Courabyra NR, Bogandyera NR, Clarkes Hill NR and at numerous locations on the western edge of Kosciuszko NP.

Extent of clearing: In the eastern part of its range (in the foothills of the Kosciuszko main range), this community is unlikely to have been widely cleared. In the western part of its range, where it occurs more often on undulating private land it may have been subject to moderate levels of clearing for pasture development.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Naughton, M. & Bourke, C.A. (2007) Primefact 694 – St John's Wort (*Hypericum perforatum*). NSW Department of Primary Industries, Orange.

u165: Robertson's Peppermint very tall shrubby open forest primarily of the Bondo subregion of the South Eastern Highlands

Scientific Name: *Eucalyptus radiata* subsp. *robertsonii* / *Platylobium montanum* – *Hibbertia obtusifolia* – *Olearia erubescens* – *Persoonia chamaepeuce* – *Pteridium esculentum* / *Lomandra longifolia* – *Gonocarpus tetragynus* – *Poa sieberiana*

Number of samples:	23
Richness [mean (±SD)]:	28 (9)
Slope (degrees):	(3) 6–20 (30)
Altitude (m asl):	(497) 751–1032 (1174)
Ave. Annual Rainfall (mm):	(836) 989–1249 (1383)
Temp. Annual Range (°C):	(24.3) 25–26.8 (28.2)

Vegetation Description: Community u165 is a very tall eucalypt open forest dominated by *Eucalyptus radiata* subsp. *robertsonii*, occasionally with other eucalypts including *Eucalyptus dives*, *Eucalyptus dalrympleana* or *Eucalyptus viminalis*. The shrub layer ranges from dense to sparse, with shrubs including *Platylobium montanum*, *Olearia erubescens*, *Persoonia chamaepeuce*, *Monotoca scoparia*, *Exocarpus strictus* and *Hibbertia obtusifolia*. *Daviesia latifolia* is abundant in recently burnt patches of forest. The ground cover is open to dense and dominated by forbs such as *Lomandra longifolia* and *Gonocarpus tetragynus*, with *Poa sieberiana* being the dominant grass species. The climber *Clematis aristata* is often present.

This community is distributed primarily in western sections of Kosciuszko NP, extending northwards to the Brindabella ranges and south to the Geehi valley in the Murray catchment. It grades into communities such as Community u105 [*Broad-leaved Peppermint – Brittle Gum – Red Stringybark tall shrub-grass dry sclerophyll open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes bioregions*], Community u239 [*Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions*], Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*] and in the Brindabellas, Community u52 [*Ribbon Gum – Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and northern Australian Alps bioregions*]. This community may extend further west into the NSW South Western Slopes bioregion.



Plate u165: Community u165 beside the Alpine Way south of Geehi Flat (near plot SZ27011M), with a canopy dominated by *Eucalyptus radiata* subsp. *robertsonii* above patches of *Acacia dealbata* and *Pomaderris lanigera* and a groundcover dominated by *Pteridium esculentum* and *Poa sieberiana*.

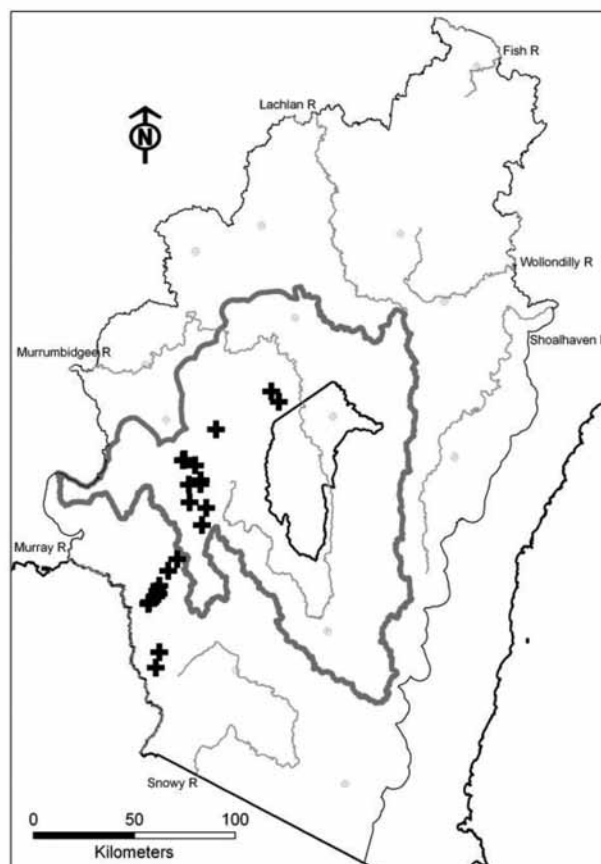


Fig. u165: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia rubida</i>	1	39	1	6			P
<i>Asperula scoparia</i>	1	57	2	22			P
<i>Brachyscome spathulata</i>	1	35	1	11			P
<i>Caladenia gracilis</i>	1	22	1	1			P
<i>Cassinia uncata</i>	2	22	2	1			P
<i>Clematis aristata</i>	1	70	1	23			P
<i>Coprosma hirtella</i>	1	39	1	12			P
<i>Coprosma quadrifida</i>	1	30	1	8			P
<i>Corybas</i> spp.	1	22	1	<1			P
<i>Craspedia jamesii</i>	1	22	1	4			P
<i>Daviesia latifolia</i>	2	39	2	7			P
<i>Eucalyptus radiata</i> subsp. <i>robertsonii</i>	3	91	3	8			P
<i>Exocarpos strictus</i>	1	35	1	12			P
<i>Gonocarpus tetragynus</i>	1	83	2	47			P
<i>Hibbertia obtusifolia</i>	1	70	1	34			P
<i>Lomandra longifolia</i>	1	87	2	42			P
<i>Monotoca scoparia</i>	1	48	1	15			P
<i>Olearia erubescens</i>	1	57	1	12			P
<i>Persoonia chamaepeuce</i>	2	52	1	11			P
<i>Pimelea linifolia</i>	1	30	1	8			P
<i>Platylobium montanum</i>	2	96	2	10			P
<i>Pteridium esculentum</i>	2	65	2	27			P
<i>Tetradlea bauerifolia</i>	1	39	1	7			P
<i>Poa sieberiana</i>	2	65	2	48			C
<i>Viola betonicifolia</i>	1	43	1	27			C

Threatened communities: Nil.

Equivalent vegetation types: This community is most similar to VCA 295 [*Robertson's Peppermint – Broad-leaved Peppermint – Norton's Box – stringybark shrub-fern open forest of the NSW South Western Slopes and South Eastern Highlands bioregions*] (Benson et al. 2010). It incorporates VG106 [*Montane Dry Shrub/Tussock Forest*] of Gellie (2005)

Frequently occurring weeds: As with many other forested communities, *Hypochaeris radicata* (0.3) is the most frequently recorded species.

Threats: There are few threats to the structure or composition of this community, however a future increase in fire frequency may alter the community structure and floristic composition.

Reservation status: Examples of this community are recorded from Brindabella NP and Kosciuszko NP.

Extent of clearing: Considered likely to be minor, although some areas have been cleared for pastoral land or *Pinus radiata* plantations. Selective logging may also have affected the age-structure of the community in some areas.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u191: Black Cypress Pine – Brittle Gum tall dry open forest on hills primarily in the Cooma region

Scientific Name: *Callitris endlicheri* – *Eucalyptus mannifera* / *Bossiaea buxifolia* – *Cassinia longifolia* – *Brachyloma daphnoides* / *Crassula sieberiana* – *Oxalis perennans* – *Austrostipa scabra* – *Chrysocephalum semipapposum*

Number of samples:	14
Richness [mean (±SD)]:	33 (10)
Slope (degrees):	(0) 6–12 (26)
Altitude (m asl):	(652) 805–910 (996)
Ave. Annual Rainfall (mm):	(507) 518–540 (614)
Temp. Annual Range (°C):	(26.3) 26.9–27.5 (27.6)

Vegetation Description: Community u191 is a tall dry open forest to woodland, with a canopy dominated by *Callitris endlicheri* and *Eucalyptus mannifera* and occasional *Eucalyptus viminalis*. The shrub layer is generally sparse and commonly includes *Brachyloma daphnoides*, *Cassinia longifolia* and *Bossiaea buxifolia*, often with dense patches of young *Callitris endlicheri*. Groundlayer vegetation is generally patchy due to high levels of litter or surface rock, with scattered large tussocks of *Rytidosperma pallidum*, and frequent forbs of low cover including *Crassula sieberiana*, *Oxalis perennans*, *Chrysocephalum semipapposum*, *Gonocarpus tetragynus*, grasses including *Austrostipa scabra*, *Rytidosperma* spp. and *Elymus scaber*, the sedge *Carex breviculmis* and the fern *Cheilanthes austrotenuifolia*.

Community u191 primarily occurs on earthy sands and lithosols derived from metasediments in hills around Cooma including Mount Gladstone and Binjura NR, extending north along Clear Range and steep lower slopes above the Murrumbidgee River. It is also recorded from steep slopes of the Molonglo River gorge near Queanbeyan. Around Cooma and Clear Range this community grades into Community m51 [*Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll open forest on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan – Gourock subregions of the South Eastern Highlands*] and Community u178 [*Yellow Box ± Apple Box tall grassy woodland of the South Eastern Highlands*] on more fertile soils lines down slope. Around Queanbeyan it grades into Community u66 [*Mealy Bundy – Red Stringybark grass-herb mid-high open forest of the South Eastern Highlands and Upper Slopes Subregion of the South Western Slopes bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia mearnsii</i>	1	36	2	3			P
<i>Aristida ramosa</i>	1	43	2	5			P
<i>Austrostipa densiflora</i>	1	21	1	1			P
<i>Austrostipa scabra</i>	1	79	2	4			P
<i>Bossiaea buxifolia</i>	1	64	1	7			P
<i>Bothriochloa macra</i>	1	29	1	3			P
<i>Brachyloma daphnoides</i>	1	64	1	16			P
<i>Callitris endlicheri</i>	2	86	3	1			P
<i>Carex breviculmis</i>	1	64	1	13			P
<i>Cassinia longifolia</i>	1	64	1	16			P
<i>Cheilanthes austrotenuifolia</i>	1	64	1	3			P
<i>Chrysocephalum apiculatum</i>	1	43	1	6			P
<i>Chrysocephalum semipapposum</i>	1	79	1	4			P
<i>Crassula sieberiana</i>	1	93	1	5			P
<i>Daucus glochidiatus</i>	1	43	1	8			P
<i>Desmodium varians</i>	1	43	1	12			P
<i>Dichelachne</i> spp.	1	21	1	2			P
<i>Einadia nutans</i>	1	36	1	4			P
<i>Elymus scaber</i>	1	71	1	21			P
<i>Eucalyptus mannifera</i>	3	57	3	11			P
<i>Euchiton involucratus</i>	1	64	1	3			P

<i>Grevillea lanigera</i>	1	29	1	3	P
<i>Lissanthe strigosa</i>	1	50	1	7	P
<i>Lomandra filiformis</i>	1	21	1	2	P
<i>Luzula densiflora</i>	1	36	1	6	P
<i>Mirbelia oxylobioides</i>	1	21	1	3	P
<i>Oxalis perennans</i>	1	86	1	13	P
<i>Poa phillipsiana</i>	1	29	3	3	P
<i>Rytidosperma</i> spp.	1	71	1	7	P
<i>Senecio quadridentatus</i>	1	29	1	6	P
<i>Themeda australis</i>	1	57	2	21	P
<i>Vittadinia cuneata</i>	1	36	1	2	P
<i>Vittadinia muelleri</i>	1	21	1	2	P
<i>Wahlenbergia communis</i>	1	29	1	5	P
<i>Wahlenbergia gracilis</i>	1	36	1	6	P
<i>Wahlenbergia stricta</i>	1	57	1	19	P
<i>Xerochrysum viscosum</i>	1	29	1	1	P
<i>Gonocarpus tetragynus</i>	1	71	2	48	C
<i>Hydrocotyle laxiflora</i>	1	43	2	30	C
<i>Poa sieberiana</i>	1	57	2	48	C
<i>Rytidosperma pallidum</i>	3	43	2	18	C

Threatened communities: Nil.

Equivalent vegetation types: This community was identified largely from field survey plots completed for the current study, and there is no equivalent Forest Ecosystem identified by Gellie (2005). It is possibly related to VG79 [*Montane Dry Shrub/Tussock Grass Forest*].

Frequently occurring weeds: This community often contains abundant weed populations, reflecting its susceptibility to over-grazing by domestic, feral or native herbivores. The most commonly recorded species were *Acetosella vulgaris* (0.29), *Echium vulgare* (0.36), *Eragrostis curvula* (0.21), *Erophila verna* (0.64), *Hypericum perforatum* (0.29), *Hypochaeris glabra* (0.29), *Hypochaeris radicata* (0.57), *Linaria arvensis* (0.57), *Lysimachia arvensis* (0.21), *Pentstemon airoides* (0.43), *Petrorhagia nanteuillii* (0.64), *Trifolium arvense* (0.64) and *Vulpia myuros* f. *megalura* (0.36).

Threats: Due to the landscape position and infertile soils, the main threat to this community is considered to be over-grazing by domestic, feral or native herbivores. This in turn may facilitate weed invasion. Where the community occurs in close proximity to urban centres, high fire frequency has the potential to impact upon species composition, structure and habitat features such as fallen timber.

Reservation status: This community is sampled from Binjura NR and Molonglo Gorge NR. It is likely to occur in Bullen Range NR and Gigerline NR in the ACT and is known to occur at Scottsdale Reserve (Bush Heritage Australia) north of Bredbo.

Extent of clearing: Likely to be minor as it occurs on low nutrient soils on hills.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate u191: *Eucalyptus mannifera* with regenerating and mature *Callitris endlicheri* and a patchy layer of *Rytidosperma pallidum* and leaf litter is characteristic of Community u191, as with this example at plot UMC125, Murrumbidgee gorge in Binjura NR north of Cooma.

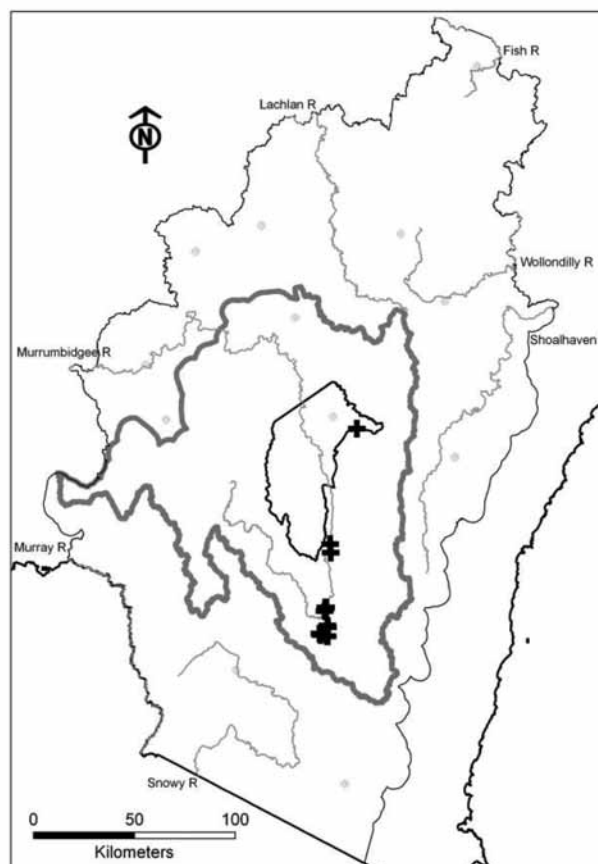


Fig. u191: Distribution of field samples assigned to this community.

Class: Upper Riverina Dry Sclerophyll Forests

u43: Mealy Bundy – *Acacia implexa* – *Allocasuarina verticillata* – *Ricinocarpos bowmanii* tall grassy open woodland on serpentinite in the Coolac-Goobarragandra area primarily of the upper South Western Slopes bioregion

Scientific Name: *Eucalyptus nortonii* / *Allocasuarina verticillata* – *Acacia implexa* / *Ricinocarpos bowmanii* – *Xanthorrhoea glauca* subsp. *angustifolia* / *Rytidosperma pilosum* – *Austrostipa scabra* – *Themeda australis*

Number of samples:	4
Richness [mean (±SD)]:	34 (2)
Slope (degrees):	(9) 14–15 (25)
Altitude (m asl):	(237) 505–644 (694)
Ave. Annual Rainfall (mm):	(687) 972–1083 (1148)
Temp. Annual Range (°C):	(26.7) 26.8–27.3 (28.5)

Vegetation Description: Community u43 is restricted to Coolac serpentinite, and generally characterised by scattered or isolated *Eucalyptus nortonii* and *Acacia implexa* within a sparse to patchy tall shrub layer of *Allocasuarina verticillata*. Frequently, *Allocasuarina verticillata* can be the dominant woody species. Distinctive scattered *Xanthorrhoea glauca* subsp. *angustifolia* and low *Ricinocarpos bowmanii* are often present. The groundlayer commonly contains a high diversity of grass taxa including *Rytidosperma pilosum*, *Austrostipa scabra*, *Bothriochloa macra*, *Themeda australis*, *Poa sieberiana*, *Panicum effusum*, *Rytidosperma racemosum* and *Elymus scaber*. Plots and observations suggest that this vegetation is also characterised by the presence of *Ptilotus* species, plants typically found in drier environments west of the study area. Other common groundlayer plants include *Carex breviculmis*, *Lomandra filiformis*, *Daucus glochidiatus*, *Senecio quadridentatus*, *Scutellaria humilis*, *Tricoryne elatior*, *Dichondra repens*, *Cheilanthes sieberi*, *Pleurosorus rutifolius*, *Convolvulus angustissimus* and *Clematis microphylla*. Field observations suggest that tree and shrub cover are patchy on the Coolac serpentinite, where this community may occur as a woodland, shrubland or grassland. Patchiness in woody plant cover in this community may result from properties of the serpentinite landscape, past clearing events, or a combination of both.

This distinctive community is restricted to soils derived from the Coolac serpentinite formation, a narrow north-south belt of mixed intrusive/metamorphic ultramafic rocks running from east of Coolac/Pettits south along the Mooney Mooney and Honeysuckle Ranges through Gobarralong, Brungle Creek, Wyangle to Goobarragandra. These soils are relatively rich in magnesium and iron-group elements (cobalt, chromium, iron, manganese and nickel) and poor in calcium and potassium, conditions which inhibit the growth of some plant species (Lyons et al. 1974). Average annual rainfall along the Honeysuckle Range is moderately high but local conditions may be harsh and dry; soils along this steep-sided range are commonly shallow to skeletal with much exposed rock, and west-facing slopes are likely to experience high summer evaporation rates.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia decora</i>	2	25	1	<1			P
<i>Acacia implexa</i>	2	100	1	2			P
<i>Acacia penninervis</i>	2	25	2	<1			P
<i>Allocasuarina verticillata</i>	3	75	1	<1			P
<i>Austrostipa densiflora</i>	1	25	1	1			P
<i>Austrostipa rudis</i>	1	25	2	<1			P
<i>Austrostipa scabra</i>	2	75	1	4			P
<i>Bothriochloa macra</i>	3	50	1	3			P
<i>Carex breviculmis</i>	2	75	1	13			P
<i>Cheilanthes sieberi</i>	2	75	1	9			P
<i>Clematis microphylla</i>	2	25	1	<1			P
<i>Convolvulus angustissimus</i>	2	75	1	3			P
<i>Crassula sieberiana</i>	1	50	1	6			P
<i>Daucus glochidiatus</i>	2	75	1	8			P
<i>Dichanthium sericeum</i>	1	25	1	<1			P
<i>Eucalyptus nortonii</i>	2	75	3	3			P
<i>Goodenia</i> spp.	2	25	1	<1			P
<i>Hibbertia calycina</i>	1	25	1	<1			P
<i>Oxalis exilis</i>	2	50	1	5			P
<i>Panicum effusum</i>	2	50	1	3			P
<i>Pleurosorus rutifolius</i>	1	25	1	<1			P
<i>Ptilotus</i> spp.	1	25	0	0			P
<i>Ptilotus semilanatus</i>	2	25	0	0			P
<i>Ricinocarpos bowmanii</i>	2	75	0	0			P
<i>Rytidosperma monticola</i>	2	25	2	1			P
<i>Rytidosperma pilosum</i>	2	75	2	9			P
<i>Rytidosperma setaceum</i>	2	25	1	<1			P
<i>Schoenus apogon</i>	1	50	1	5			P
<i>Scutellaria humilis</i>	2	50	1	2			P
<i>Senecio bathurstianus</i>	1	25	1	1			P
<i>Senecio quadridentatus</i>	2	100	1	6			P
<i>Themeda australis</i>	2	100	2	21			P
<i>Thysanotus patersonii</i>	1	25	1	1			P
<i>Tricoryne elatior</i>	2	50	1	4			P
<i>Wahlenbergia gracilentia</i>	1	50	1	<1			P
<i>Wahlenbergia luteola</i>	2	50	1	1			P
<i>Xanthorrhoea glauca</i> subsp. <i>angustifolia</i>	3	75	2	<1			P
<i>Dichondra repens</i>	2	50	2	21			C
<i>Elymus scaber</i>	2	50	1	21			C
<i>Gonocarpus tetragynus</i>	1	50	2	48			C
<i>Hovea linearis</i>	1	50	1	13			C
<i>Hydrocotyle laxiflora</i>	1	50	2	30			C
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	1	75	2	19			C
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	2	50	1	16			C
<i>Oxalis perennans</i>	2	50	1	13			C
<i>Poa sieberiana</i>	2	75	2	48			C
<i>Rumex brownii</i>	1	50	1	9			C
<i>Rytidosperma racemosum</i>	3	50	2	10			C

Threatened communities: Nil, but may be eligible for listing.

Equivalent vegetation types: Identified by Mulvaney et al. (2005) as Serpentine Woodland, and by Benson et al. (2010) as VCA 301 [*Drooping Sheoke* – *Ricinocarpos bowmannii* – *grasstree tall open shrubland of the Coolac – Tumut Serpentine Belt*].

Frequently occurring weeds: Grazed areas of this community are widely invaded by common south-western slopes exotic pasture plants. The following exotic plant taxa were recorded in 30% or more of plots assigned to this type: *Acetosella vulgaris* (0.5), *Avena barbata* (0.5), *Briza maxima* (1.00), *Bromus diandrus* (0.75), *Bromus hordeaceus* (0.5), *Carthamus lanatus* (0.5), *Hypericum perforatum* (0.75), *Hypochaeris glabra* (0.5), *Petrorhagia nanteuilii* (1), *Rosa rubiginosa* (0.5), *Rostraria cristata* (0.5), *Sonchus oleraceus* (0.5), *Trifolium angustifolium* (0.75), *Trifolium arvense* (0.5), *Trifolium campestre* (0.5), *Trifolium dubium* (0.5), *Trifolium glomeratum* (0.5).



Plate u43: Community u43 with scattered *Allocasuarina verticillata*, *Eucalyptus nortonii* and *Acacia decora* growing on a serpentine substrate. Honeysuckle Range, plot UMC418.

Plate u66: Community u66 dominated by *Eucalyptus nortonii* with a patchy shrub and ground layer. Isaacs Ridge NR, ACT.

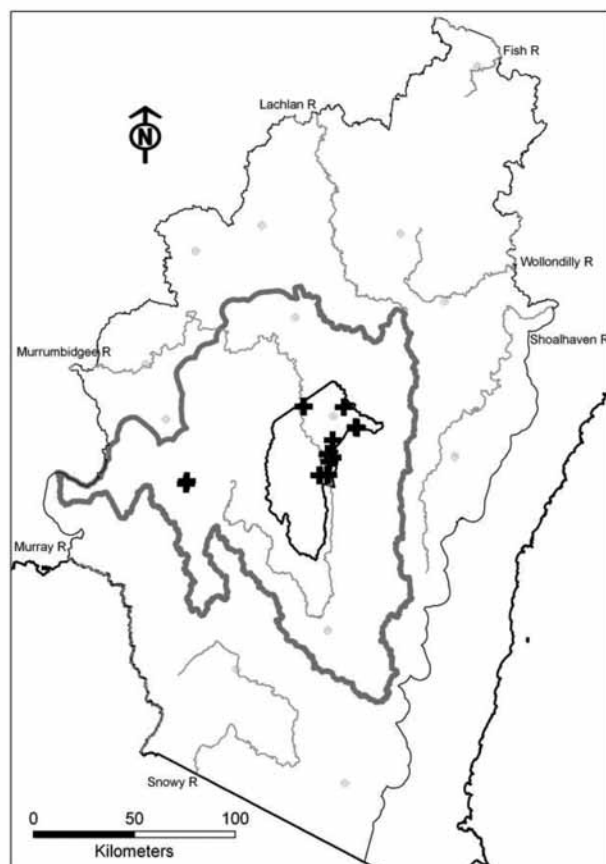
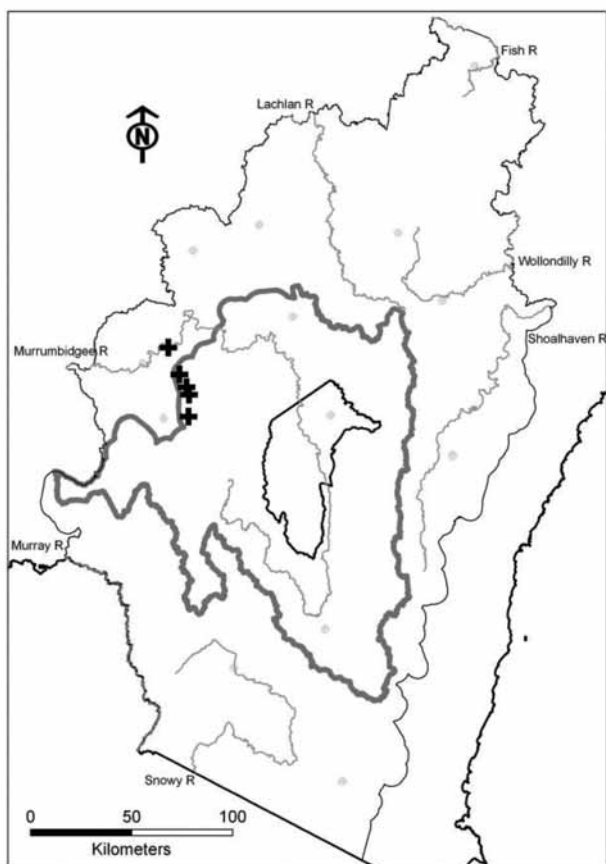


Fig. u43: Distribution of field samples assigned to this community.

Fig. u66: Distribution of field samples assigned to this community.

Threats: Community u43 is grazed by stock across most of its extent, and some areas have been subject to clearing of tree or shrub layers. Mineral prospecting and mining may have local impacts; past mining took place at Tumut Gold Mine and McAlpine Mine, and significant areas of serpentinite are covered by current mineral exploration licences.

Reservation status: Not represented in any conservation reserves. Small areas exist in two TSRs, at the north and south ends of its range; a larger area is within Red Hill SF (which may be subject to a grazing lease); the remainder is private freehold.

Extent of clearing: Uncertain. Further investigation is required into the causes of the sparse tree and shrub cover observed across this landscape; whether it is partially due to the influence of serpentinite on plant growth, or is an artefact of historic clearing for pasture development. Some areas may have been cleared, but it is also possible that some areas are naturally open.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Lyons, M.T., Brooks, R.R. & Craig, D.C. (1974) The influence of soil composition on the vegetation of the Coolac serpentinite belt in New South Wales. *Journal and Proceedings of the Royal Society of New South Wales* 107: 67–75; Mulvaney, M., Boak, M., Priday, S., Hudson, K. & Crane, M. (2005) The native vegetation of Gundagai shire. NSW Department of Environment and Conservation, Queanbeyan.

u66: Mealy Bundy – Red Stringybark grass-forb mid-high open forest of the South Eastern Highlands and Upper Slopes Subregion of the South Western Slopes bioregion

Scientific Name: *Eucalyptus nortonii* ± *Eucalyptus macrorhyncha* – *Eucalyptus polyanthemos* / *Cassinia longifolia* – *Hibbertia obtusifolia* / *Poa sieberiana* – *Daucus glochidiatus* – *Cheilanthes austrotenuifolia*

Number of samples:	16
Richness [mean (±SD)]:	41 (10)
Slope (degrees):	(8) 12–19 (28)
Altitude (m asl):	(443) 613–740 (812)
Ave. Annual Rainfall (mm):	(611) 672–724 (1076)
Temp. Annual Range (°C):	(25.8) 26.3–27.1 (27.5)

Vegetation Description: Community u66 is a mid-high open woodland to open forest characterised by *Eucalyptus nortonii* often with *Eucalyptus macrorhyncha* or *Eucalyptus polyanthemos*, and occasionally with *Brachychiton populneus* or *Callitris endlicheri*. *Allocasuarina verticillata* and *Acacia implexa* may be present in low abundance in the midstorey, along with shrubs including *Cassinia longifolia*, *Bursaria spinosa*, *Pimelea curviflora* and *Hibbertia obtusifolia*. The groundlayer is generally patchy with grasses including *Poa sieberiana*, *Rytidosperma* spp. and *Austrostipa scabra* and forbs including *Hydrocotyle laxiflora*, *Daucus glochidiatus*, *Acaena ovina*, *Geranium solanderi*, *Gonocarpus tetragynus*, *Lomandra filiformis* subsp. *filiformis* and *Wahlenbergia stricta*. The fern *Cheilanthes austrotenuifolia* and sedge *Carex appressa* may be present.

Community u66 is located mainly on low hills of sandstone and acid-volcanic (ignimbrite, rhyolite, tuff) substrates within the northern ACT and surrounds, with further occurrences sampled from steep slopes around Talbingo to the west. It is likely that this community requires greater floristic sampling to refine its description. Around Canberra, it generally occurs on slightly less fertile soils than Community u29 [*Apple Box* – *Broad-leaved Peppermint tall shrub-grass woodland primarily on granitoids of the South Eastern Highlands bioregion*] and

Community u178 [*Yellow Box ± Apple Box tall grassy woodland of the South Eastern Highlands*]. Around Talbingo it grades into Community u148 [*Red Stringybark – Red Box grass-forb tall open forest of the upper South Western Slopes and western South Eastern Highlands bioregions*].

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O	Fid
<i>Acacia implexa</i>	1	31	1	2		P
<i>Acaena ovina</i>	1	69	1	8		P
<i>Ajuga australis</i>	1	31	1	8		P
<i>Allocasuarina verticillata</i>	1	38	1	<1		P
<i>Austrostipa scabra</i>	1	56	2	4		P
<i>Bothriochloa macra</i>	1	31	1	3		P
<i>Brachychiton populneus</i>	1	31	1	2		P
<i>Bursaria spinosa</i>	1	63	1	10		P
<i>Callitris endlicheri</i>	1	31	2	1		P
<i>Carex inversa</i>	1	63	1	8		P
<i>Cassinia longifolia</i>	1	75	1	16		P
<i>Cheilanthes austrotenuifolia</i>	1	69	1	3		P
<i>Cheilanthes sieberi</i>	1	50	1	9		P
<i>Clematis leptophylla</i>	1	50	1	1		P
<i>Crassula sieberiana</i>	1	56	1	5		P
<i>Cymbonotus lawsonianus</i>	1	38	1	5		P
<i>Cynoglossum suaveolens</i>	1	44	1	3		P
<i>Daucus glochidiatus</i>	1	75	1	8		P
<i>Desmodium varians</i>	1	56	1	12		P
<i>Dodonaea viscosa</i>	1	25	1	2		P
<i>Eucalyptus nortonii</i>	3	63	3	3		P
<i>Eucalyptus polyanthemos</i>	3	31	3	3		P
<i>Euchiton sphaericus</i>	1	50	1	7		P
<i>Galium gaudichaudii</i>	1	50	1	10		P
<i>Geranium solanderi</i>	1	69	1	19		P
<i>Hibbertia obtusifolia</i>	1	75	1	34		P
<i>Hydrocotyle laxiflora</i>	1	100	2	29		P
<i>Kunzea ericoides</i>	1	38	2	4		P
<i>Lepidosperma laterale</i>	1	63	1	9		P
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	1	69	1	16		P
<i>Luzula densiflora</i>	1	38	1	6		P
<i>Oxalis perennans</i>	1	56	1	13		P
<i>Pimelea curviflora</i>	1	50	1	6		P
<i>Plantago varia</i>	1	44	1	11		P
<i>Poa sieberiana</i>	1	94	2	48		P
<i>Pterostylis nana</i>	1	31	1	<1		P
<i>Pultenaea procumbens</i>	1	31	1	4		P
<i>Rumex brownii</i>	1	38	1	9		P
<i>Rytidosperma</i> spp.	1	63	1	7		P
<i>Scutellaria humilis</i>	1	31	1	1		P
<i>Senecio quadridentatus</i>	1	50	1	5		P
<i>Vittadinia cuneata</i>	1	31	1	2		P
<i>Wahlenbergia</i> spp.	1	25	1	5		P
<i>Wahlenbergia stricta</i>	1	69	1	18		P
<i>Wurmbea dioica</i>	1	38	1	3		P
<i>Glycine clandestina</i>	1	56	1	29		C
<i>Gonocarpus tetragynus</i>	1	69	2	48		C
<i>Hypericum gramineum</i>	1	56	1	25		C
<i>Senecio prenanthoides</i>	1	50	1	19		C

Threatened communities: Nil.

Equivalent vegetation types: No obvious equivalent communities. There are a number of similar VCA plant communities including VCA 294, 297, 306, 310, 311 and 316 (Benson et al. 2010).

Frequently occurring weeds: This community is widely distributed across freehold (leasehold in the ACT) grazing land, and has experienced substantial disturbance and subsequent weed invasion. Weed species typical of the grazing environments of the Southern Tablelands and South Western Slopes are prevalent within this community, most notably

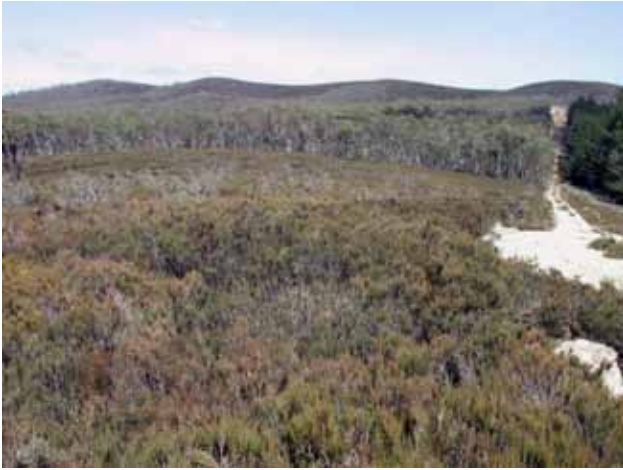


Plate e53: Community e53 in foreground, characterised by dense thickets of *Allocasuarina nana*. Coolumbooka NR.

Aira elegantissima (0.38), *Briza minor* (0.31), *Bromus diandrus* (0.38), *Hypericum perforatum* (0.38), *Hypochaeris radicata* (0.75), *Lysimachia arvensis* (0.31), *Orobanche minor* (0.31), *Petrorhagia nanteuilii* (0.5), *Rosa rubiginosa* (0.44), *Sonchus oleraceus* (0.31), *Trifolium arvense* (0.88), *Trifolium campestre* (0.5), *Trifolium glomeratum* (0.31) and *Vulpia myuros* (0.44).

Threats: Grazing continues to degrade this community, reducing native species diversity and encouraging weed invasion. It is also likely that minor to moderate clearing still occurs, along with the removal of fallen timber for firewood.

Reservation status: Examples of this community are found in Kosciuszko NP and Namadgi NP as well as Isaac Ridge, Mt. Majura, Rob Roy Reserve and Tuggeranong Hill Reserve (parts of Canberra Nature Park).

Extent of clearing: Likely to be moderately cleared where it occurs on lower slopes or in close proximity to fertile farming country.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney.

Formation: Heathlands

Class: Southern Montane Heaths

e53: *Allocasuarina nana* shrubland on exposed skeletal ridges primarily in the eastern South Eastern Highlands bioregion

Scientific Name: *Allocasuarina nana* – *Brachyloma daphnoides* / *Lomandra glauca* – *Gonocarpus tetragynus* – *Stylidium graminifolium sens. lat.*

Number of samples:	22
Richness [mean (\pm SD)]:	19 (9)
Slope (degrees):	(0) 6–16 (21)
Altitude (m asl):	(506) 678–857 (1081)
Ave. Annual Rainfall (mm):	(584) 881–957 (1018)
Temp. Annual Range ($^{\circ}$ C):	(23.1) 23.6–24.2 (25.6)

Vegetation Description: Community e53 is a dense shrubland to 1.5 metres tall (but often less than 0.5 metres) dominated by *Allocasuarina nana* and *Brachyloma daphnoides*, with *Hakea dactyloides* frequently occurring as an emergent to 3 metres tall. *Epacris impressa*, *Dampiera* spp. and prostrate shrubs including *Isopogon prostratus* and *Mirbelia platylobioides* are also common. Where breaks in the dense shrub layer occur, patches of grasses and sedges are common, including *Rytidosperma pallidum*, *Lomandra glauca* and *Lepidosperma tortuosum*, along with forbs including *Stylidium graminifolium sens. lat.*, *Gonocarpus tetragynus* and *Patersonia sericea* var. *longifolia*. The Endangered (TSC Act 1995) *Westringia kydensis* and *Dampiera fusca* are known to occur in this community, as are the rare *Euryomyrtus denticulata* and *Haloragodendron monospermum*. Species diversity appears to increase further north of the upper Murrumbidgee catchment. Occasionally, sparse to isolated emergent *Eucalyptus dives* or other eucalypts from adjacent forest communities may be present.

Community e53 is defined by data from sites extending from Coolumbooka NR (east of Bombala) to north of Mongarlowe. Within the upper Murrumbidgee catchment, it is known to occur on exposed

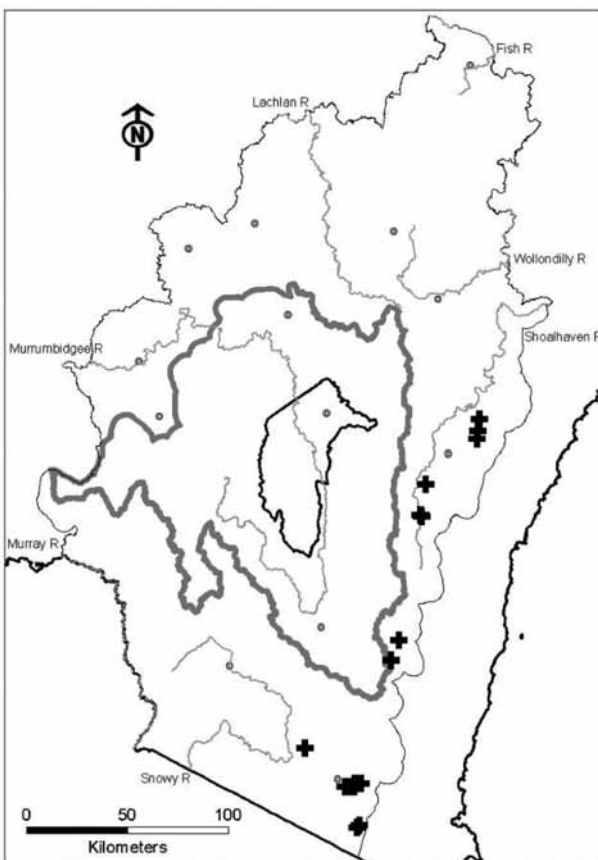


Fig. e53: Distribution of field samples assigned to this community.

slopes and ridges in Dangelong NR south of Numeralla, and may occur further north within the catchment in similar situations on the western fall of the Great Divide. It occurs on skeletal sandy loams derived from metasediments, acid volcanics or granitoids, and is likely to occur in exposed areas associated with Community p9 [*Brittle Gum – Scribbly Gum shrubby tall dry open forest*] and Community e24 [*Mountain Gum – Snow Gum subalpine very tall dry shrubby open forest primarily in the Kybeyan – Gourock subregion of the South Eastern Highlands bioregion*], and possibly other communities on ridge country in the east of the upper Murrumbidgee catchment.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Allocasuarina nana</i>	5	100	2	<1			P
<i>Austrostipa pubinodis</i>	2	29	2	<1			P
<i>Brachyloma daphnoides</i>	2	81	1	16			P
<i>Cassytha glabella</i>	1	29	1	<1			P
<i>Dampiera</i> spp.	2	38	1	<1			P
<i>Entolasia stricta</i>	2	29	2	4			P
<i>Epacris impressa</i>	2	33	2	3			P
<i>Gompholobium huegelii</i>	2	24	1	5			P
<i>Gompholobium minus</i>	1	24	1	1			P
<i>Hakea dactyloides</i>	2	48	2	3			P
<i>Isopogon prostratus</i>	2	33	2	<1			P
<i>Lepidosperma gunnii</i>	2	29	1	5			P
<i>Lepidosperma tortuosum</i>	1	38	1	<1			P
<i>Lomandra glauca</i>	2	52	2	4			P
<i>Mirbelia platylobioides</i>	2	33	1	<1			P
<i>Patersonia sericea</i> var. <i>longifolia</i>	2	33	2	1			P
<i>Platysace lanceolata</i>	2	29	2	5			P
<i>Rytidosperma pallidum</i>	2	48	2	17			P
<i>Rytidosperma tenuius</i>	1	24	2	1			P
<i>Stylidium graminifolium</i> sens. lat.	1	62	1	25			P
<i>Gonocarpus tetragynus</i>	1	62	2	48			C

Threatened communities: Nil.

Equivalent vegetation types: This community is equivalent to HLe53 [*Southern Montane Heath*] described by Tozer et al. (2010), and overlaps with the communities VG134 [*Eastern Tablelands Dry Heath*] and VG135 [*Southern Escarpment (Wadbilliga) Moist Heath*] identified by Gellie (2005), with the latter type defined by additional dominant species including *Kunzea* sp. 'Wadbilliga' and *Banksia canei*.

Frequently occurring weeds: No exotic taxa have been recorded from this community, probably due to its occurrence on exposed and infertile substrates.

Threats: Because this community occurs on soils of low fertility and in exposed situations, clearing has been minimal. Grazing threats are likely to be minimal due to a dominance of relatively unpalatable species and difficulty of stock penetrating its dense shrubby layer. Infrequent fire may be changing the structure and composition of this community, with observations suggesting an optimum burn frequency of once every 10 – 25 years (J. Miles, pers. comm.). Too frequent fire may affect the occurrence of obligate seeders.

Reservation status: While the distribution within the upper Murrumbidgee catchment is unknown, all known examples are conserved in Dangelong NR. To the east of the upper Murrumbidgee catchment, more than 50% of the estimated pre-clearing extent of Community e53 (as defined by Tozer et al. 2010) is considered to be reserved.

Extent of clearing: Due to its occurrence in exposed locations and on soils of low fertility, this community is considered to be largely intact (Tozer et al. 2010).

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer,

M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

Formation: Forested Wetlands

Class: Eastern Riverine Forests

p32d: River She-oak riparian forest on sand/gravel alluvial soils along major watercourses of the South Eastern Highlands and upper South Western Slopes bioregions

Scientific Name: *Casuarina cunninghamiana* / *Acacia dealbata* / *Microlaena stipoides* – *Dichondra repens* – *Lomandra longifolia* – *Echinopogon ovatus* – *Poa labillardierei*

Number of samples:	15
Richness [mean (±SD)]:	28 (8)
Slope (degrees):	(0) 5–26 (36)
Altitude (m asl):	(259) 507–622 (702)
Ave. Annual Rainfall (mm):	(688) 697–728 (909)
Temp. Annual Range (°C):	(25.5) 26.3–27.6 (28.6)

Vegetation Description: Community p32d is characterised by a tall tree canopy of *Casuarina cunninghamiana*. The shrub layer is often sparse and may include scattered *Acacia dealbata*, *Bursaria spinosa* or *Kunzea ericoides*, and patches of young *Casuarina cunninghamiana* plants. Groundlayer is often dominated by bare soil/rock and thick litter of *Casuarina cunninghamiana* branchlets, and a dense tree canopy often contributes to a shady moist ground environment. Groundlayer plants may be sparse or patchy, and frequent species include *Dichondra repens*, *Echinopogon ovatus*, *Geranium solanderi*, *Microlaena stipoides*, *Poa labillardierei*, *Rumex brownii*, *Hydrocotyle laxiflora*, *Lomandra longifolia* and a variety of small ferns and sedges.

This community occurs across the study area on major rivers and streams including the Murrumbidgee, Abercrombie, Tarlo and Wollondilly Rivers. Plots assigned to Community p32d by the current study were recorded from the Retreat and Abercrombie Rivers in the north of the study area to lower altitudes on rivers in the ACT, on the Murrumbidgee River below Burrinjuck Dam and along the Goodradigbee River. This community occurs on river gravel, cobbles and coarse sandy alluvium along permanent and semi-permanent watercourses in relatively narrow confined channels subject to high-velocity flows. On meandering tableland watercourses with deeper, finer-grained alluvial silts and loams, it is replaced by Community u173 [*River Red Gum ± Apple Box very tall grass-forb riparian woodland on alluvial flats in the South Eastern Highlands and upper South Western Slopes bioregions*]. To the west of the study area where major rivers cut through deep fine-grained silts and loams and sand lenses on broad river flats, it is replaced on riverbanks by a mixed River Red Gum – River She-oak community (e.g. see Mulvaney et al. 2005), which occurs in the study area on broad sandy flats on the Murrumbidgee at Jugiong and Gobarralong in the South Western Slopes. A similar but distinct River She-oak dominated community with increasing elements of moist eucalypt forest and rainforest in the midstorey and groundlayer (FoWp32 described by Tozer et al. 2010) occurs to the east of the study area in coastal escarpment streams.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O Fid
<i>Adiantum aethiopicum</i>	1	38	2	3	P
<i>Asplenium flabellifolium</i>	1	44	1	9	P
<i>Bursaria spinosa</i>	1	50	1	10	P
<i>Carex</i> spp.	2	25	1	2	P
<i>Casuarina cunninghamiana</i>	4	100	4	<1	P
<i>Cheilanthes sieberi</i>	1	38	1	9	P
<i>Dichondra repens</i>	2	81	2	20	P
<i>Echinopogon ovatus</i>	1	63	1	10	P
<i>Eucalyptus bridgesiana</i>	1	31	3	7	P
<i>Geranium solanderi</i>	1	56	1	19	P
<i>Kunzea ericoides</i>	3	38	2	4	P
<i>Microlaena stipoides</i>	2	94	2	34	P
<i>Pellaea falcata</i>	1	25	2	2	P
<i>Plantago debilis</i>	2	25	2	4	P
<i>Poa labillardierei</i>	1	50	2	10	P
<i>Rumex brownii</i>	1	63	1	9	P
<i>Rytidosperra racemosum</i>	2	38	2	10	P
<i>Senecio quadridentatus</i>	2	38	1	5	P
<i>Urtica incisa</i>	1	38	1	2	P
<i>Acacia dealbata</i>	2	56	2	26	C
<i>Acaena novae-zelandiae</i>	2	50	1	28	C
<i>Hydrocotyle laxiflora</i>	2	56	2	30	C
<i>Lomandra longifolia</i>	2	75	2	42	C
<i>Stellaria pungens</i>	2	50	2	31	C

Threatened communities: Nil.

Equivalent vegetation types: This community is closely related to FoWp32 [*Riverbank Forest*] described by Tozer *et al.* (2010) for the coast and tablelands. The inclusion of additional tableland and slopes field samples in the current study area indicates that a split is warranted between the moist *Casuarina cunninghamiana* forests of the coast and coastal escarpments with their rainforest and wet sclerophyll elements, and the drier *Casuarina cunninghamia* forests of the tablelands and slopes containing elements of adjacent dry forests and woodlands. Community p32d also represents a dry subset of VG53 [*Riparian Acacia Shrub/Grass/Herb Forest*] described by Gellie (2005), and is described by Benson *et al.* (2010) as VCA 85 [*River Oak forest and woodland wetland of the NSW South-western Slopes and South Eastern Highlands bioregions*].

Frequently occurring weeds: This community is susceptible to invasion by a wide variety of exotic plant species. The following taxa were recorded from 30% or more of plots assigned to this community: *Acetosella vulgaris* (0.57), *Cirsium vulgare* (0.36), *Conyza bonariensis* (0.43), *Euphorbia peplus* (0.36), *Holcus lanatus* (0.36), *Hypochaeris radicata* (0.71), *Lysimachia arvensis* (0.43), *Modiola caroliniana* (0.43), *Plantago lanceolata* (0.36), *Prunella vulgaris* (0.43), *Rosa rubiginosa* (0.43), *Rubus fruticosus* sp. agg. (0.5), *Sonchus oleraceus* (0.79).

Threats: Generally not cleared, as it tends to be restricted to a narrow band of relatively infertile sand/gravel/cobble alluvium subject to frequent flooding. In some tableland rural environments a narrow strip of this community may be the only extant woody vegetation. However, many examples of this community across all tenures are degraded by weed invasion, and examples on private land are commonly subject to frequent stock grazing.

Reservation status: Plots were recorded from Abercrombie River NP, Brindabella SCA, Burrinjuck NR, Razorback NR and Tarlo River NP in NSW, and Woodstock NR, Stony Creek NR, Bullen Range NR and Kambah Pool Recreation Area in the ACT. Likely to occur in many other conservation reserves along permanent watercourses in dissected country.

Extent of clearing: Generally minor.



Plate p32d: Community p32d on the Murrumbidgee River beside Nanangroe Road (plot UMC404), dominated by *Casuarina cunninghamiana* with woody debris from December 2010 floods.

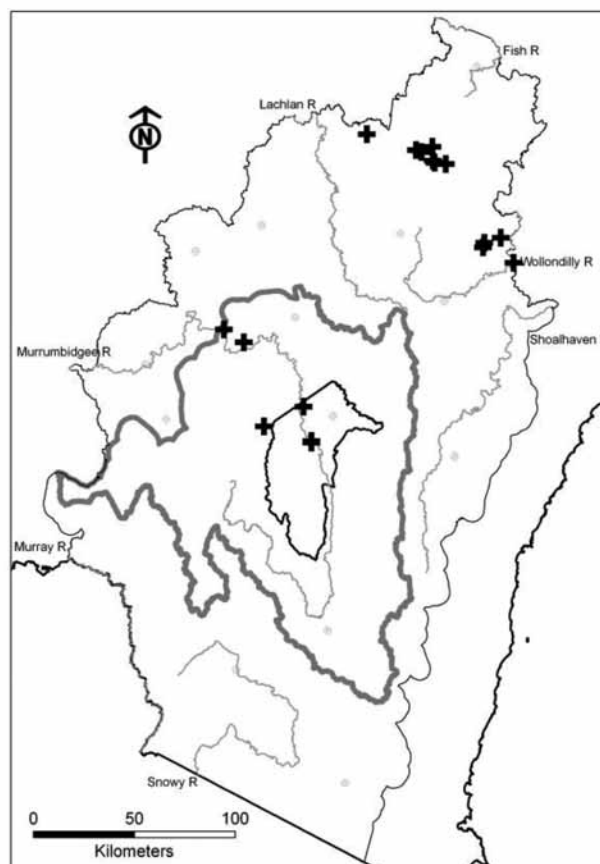


Fig. p32d: Distribution of field samples assigned to this community.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

p56: *Leptospermum grandifolium* – *Hakea microcarpa* – *Lomatia myricoides* very tall riparian shrubland of the eastern South Eastern Highlands bioregion

Scientific Name: *Leptospermum grandifolium* – *Hakea microcarpa* – *Lomatia myricoides* – *Leptospermum obovatum* / *Carex gaudichaudiana* – *Poa labillardierei* – *Scirpus polystachyus*

Number of samples:	9
Richness [mean (±SD)]:	24 (5)
Slope (degrees):	(1) 3–6 (21)
Altitude (m asl):	(505) 721–916 (993)
Ave. Annual Rainfall (mm):	(605) 710–916 (1032)
Temp. Annual Range (°C):	(23.2) 24.2–25.9 (26.5)

Vegetation Description: Community p56 is a distinctive riparian shrubland that occurs in a narrow band along beds and lower terraces of rivers and major streams of the eastern southern tablelands where substrates are dominated by exposed bedrock with shallow to skeletal pockets of coarse sand, gravel or cobble alluvium. A tree layer is often absent, or exists as scattered small individuals of from adjacent plant communities including *Eucalyptus viminalis* and *Eucalyptus pauciflora* subsp. *pauciflora*. A characteristic dense to patchy layer of low to tall shrubs is commonly dominated by *Hakea microcarpa*, *Leptospermum grandifolium*, *Leptospermum obovatum*, *Lomatia myricoides* and other riparian taxa. Groundlayer ranges from dense to patchy depending on flood disturbance and levels of bare rock and open water cover; areas of exposed sandy soil are commonly bound by tussocks of *Poa labillardierei*, *Lomandra longifolia* and *Carex appressa* and soft herbs including *Epilobium* spp., *Hydrocotyle sibthorpioides* and *Acaena novae-zelandiae*, while flow-lines, pools and wet banks contain a mix of aquatic and semi-aquatic plants commonly including *Carex gaudichaudiana*, *Juncus*, *Ranunculus* and *Myriophyllum* spp. and tall clumps of *Scirpus polystachyus*.

This community is recorded from eastern tableland streams subject to frequent high-velocity flows, including the upper Shoalhaven and upper Tuross Rivers, Bredbo River, Big Badja River, Maclaughlin River, Bombala River, Dragon Swamp Creek and White Rock River, and is likely to occur on other streams across this range with suitable rocky alluvial habitat. Where deeper sandy alluvial deposits develop, this community is replaced by Community p520 [*Ribbon Gum very tall woodland on alluvial soils along drainage lines of the eastern South Eastern Highlands bioregion*]. Further to the west on similar shallow sand/gravel/cobble alluvium it is replaced by Community u181 [*Callistemon sieberi* – *Kunzea ericoides* rocky riparian tall shrubland in the South Eastern Highlands and upper South Western Slopes bioregions].



Plate p56: Community p56 with *Leptospermum obovatum* and a diverse array of grasses, sedges, rushes and forbs fringing the Bredbo River south of Jerangle, Frogs Hollow TSR (plot UMC425).

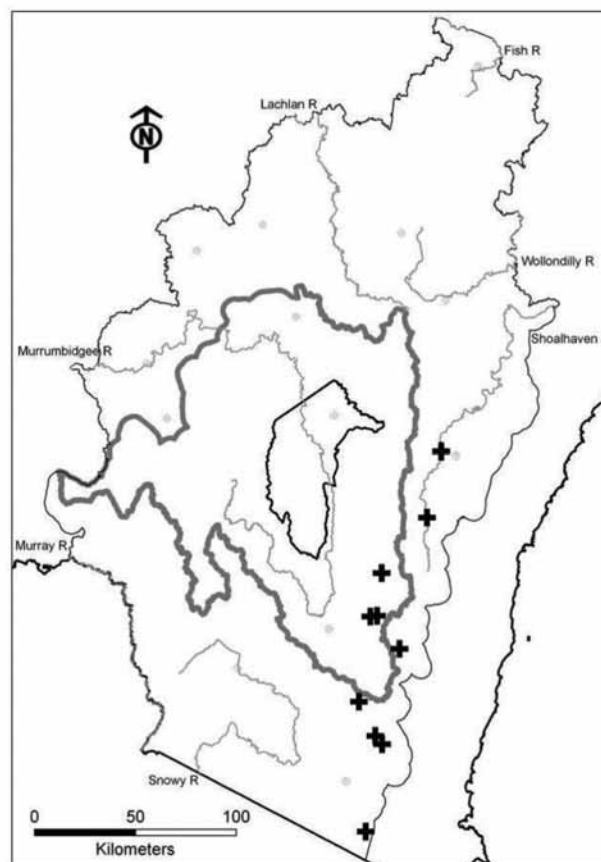


Fig. p56: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acacia siculiformis</i>	2	22	1	<1	P
<i>Blechnum minus</i>	2	22	1	1	P
<i>Callistemon subulatus</i>	2	33	1	<1	P
<i>Carex appressa</i>	2	44	1	7	P
<i>Carex gaudichaudiana</i>	3	89	2	4	P
<i>Elatine gratioloides</i>	1	33	1	<1	P
<i>Epilobium</i> spp.	2	67	1	1	P
<i>Eucalyptus viminalis</i>	1	67	3	13	P
<i>Grevillea lanigera</i>	2	44	1	3	P
<i>Hakea microcarpa</i>	2	78	1	3	P
<i>Hydrocotyle sibthorpioides</i>	2	44	2	4	P
<i>Hypericum japonicum</i>	2	44	1	4	P
<i>Juncus falcatus</i>	2	22	1	<1	P
<i>Juncus gregiflorus</i>	2	22	1	<1	P
<i>Leptospermum grandifolium</i>	3	67	3	2	P
<i>Leptospermum lanigerum</i>	5	22	2	<1	P
<i>Leptospermum obovatum</i>	3	56	1	<1	P
<i>Lomatia myricoides</i>	2	56	1	12	P
<i>Micranthemum hexandrum</i>	1	22	1	<1	P
<i>Myriophyllum</i> spp.	2	33	2	<1	P
<i>Ozothamnus ferrugineus</i>	1	22	2	<1	P
<i>Persicaria prostrata</i>	1	22	2	1	P
<i>Poa labillardierei</i>	2	89	2	10	P
<i>Pultenaea altissima</i>	1	33	1	<1	P
<i>Ranunculus amphitrichus</i>	1	44	2	<1	P
<i>Schoenoplectus validus</i>	2	22	1	<1	P
<i>Scirpus polystachyus</i>	2	67	1	<1	P
<i>Typha orientalis</i>	1	22	0	0	P
<i>Acaena novae-zelandiae</i>	2	44	1	28	C
<i>Elymus scaber</i>	1	44	1	21	C
<i>Lomandra longifolia</i>	2	56	2	42	C

Threatened communities: Nil.

Equivalent vegetation types: This community is equivalent to FrWp56 [*Shoalhaven Riparian Scrub*] identified by Tozer *et al.* (2010), with the addition of a new plot from the Bredbo River.

Frequently occurring weeds: This riparian community is relatively moist and is subject to frequent disturbance by flooding, so is prone to invasion by a variety of exotic plant species. The following taxa were recorded from 30% or more of plots assigned to this community: *Acetosella vulgaris* (0.33), *Anthoxanthum odoratum* (0.33), *Holcus lanatus* (0.67), *Hypochaeris radicata* (0.44), *Plantago lanceolata* (0.33), *Prunella vulgaris* (0.56).

Threats: Weed invasion is likely to be the main ongoing threat to this community, particularly invasive perennial weeds such as *Rubus fruticosus* spp. agg. and *Hypericum perforatum* with the ability to survive major floods and gradually dominate the riparian zone and displace native plants.

Reservation status: Recorded from Deua NP and South East Forest NP, also likely to occur in many other conservation reserves along the eastern tableland ranges.

Extent of clearing: Likely to be very minor due to its rocky, flood-prone habitat.

References: Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

u181: *Callistemon sieberi* – *Kunzea ericoides* rocky riparian tall shrubland in the South Eastern Highlands and upper South Western Slopes bioregions

Scientific Name: *Callistemon sieberi* – *Kunzea ericoides* – *Acacia rubida* – *Bursaria spinosa* / *Rumex brownii* – *Lythrum hyssopifolia* – *Lomandra longifolia*

Number of samples:	10
Richness [mean (±SD)]:	25 (6)
Slope (degrees):	(0) 4–19 (25)
Altitude (m asl):	(360) 462–607 (749)
Ave. Annual Rainfall (mm):	(605) 648–675 (962)
Temp. Annual Range (°C):	(26.7) 27–27.4 (28)

Vegetation Description: Community u181 is characteristically a tall to low riparian shrubland, with a patchy to dense layer of shrubs commonly dominated by *Callistemon sieberi* and *Kunzea ericoides* with scattered *Acacia rubida* and *Bursaria spinosa*. Scattered emergent or flood-stunted trees sometimes occur. Ground cover tends to be dominated by exposed rock and bare sand/gravel alluvium, with scattered or patchy low moisture-loving plants including sedge and rush tussocks of *Lomandra longifolia*, *Juncus* spp. and *Carex appressa*, with forbs including *Lythrum hyssopifolia*, *Rumex brownii*, *Persicaria* spp. and *Epilobium* spp. and grasses such as *Rytidosperma racemosum*, *Microlaena stipoides* and *Elymus scaber*. *Eucalyptus camaldulensis* may be found as part of or adjacent to this community, where it is at the eastern edge of its range.

This community has been recorded from the Murrumbidgee River (around Michelago, Gigerline and Greenway), the Molonglo gorge and a Queanbeyan River tributary, in Yass River gorge and tributaries (Bogolong Creek), and on the Goobarragandra River east of Tumut. It was also observed on Lerida Creek near Gunning, and may occur elsewhere across western parts of the study area in suitable rocky riparian habitats. This community appears to be restricted to riparian areas of exposed rocky substrate with skeletal or shallow pockets of gravelly soil along western tableland streams, often in confined gorges through hilly country but also on small bedrock reefs exposed in streams through undulating tableland/slopes country.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acacia dawsonii</i>	1	20	1	<1	P
<i>Acacia rubida</i>	2	70	1	6	P
<i>Alternanthera denticulata</i>	1	20	1	<1	P
<i>Bursaria spinosa</i>	1	60	1	10	P
<i>Callistemon sieberi</i>	2	100	2	<1	P
<i>Callitris endlicheri</i>	2	40	3	1	P
<i>Calytrix tetragona</i>	2	30	2	1	P
<i>Carex appressa</i>	1	50	1	7	P
<i>Cassinia</i> spp.	1	20	1	1	P
<i>Cheilanthes sieberi</i>	1	50	1	9	P
<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	1	50	1	<1	P
<i>Epilobium</i> spp.	1	20	1	1	P
<i>Eucalyptus camaldulensis</i>	3	20	4	<1	P
<i>Juncus</i> spp.	1	30	1	2	P
<i>Juncus usitatus</i>	1	20	1	<1	P
<i>Kunzea ericoides</i>	2	90	2	4	P
<i>Leptospermum obovatum</i>	1	20	3	<1	P
<i>Lespedeza juncea</i> subsp. <i>sericea</i>	2	30	1	<1	P
<i>Lythrum hyssopifolia</i>	1	60	1	<1	P
<i>Paspalum distichum</i>	2	20	2	<1	P
<i>Persicaria hydropiper</i>	2	20	1	<1	P

<i>Persicaria prostrata</i>	2	20	2	1	P
<i>Pomaderris angustifolia</i>	1	20	1	<1	P
<i>Rumex brownii</i>	1	70	1	9	P
<i>Rytidosperma racemosum</i>	2	50	2	10	P
<i>Acacia dealbata</i>	1	40	2	26	C
<i>Elymus scaber</i>	2	50	1	21	C
<i>Geranium solanderi</i>	1	50	1	19	C
<i>Lomandra longifolia</i>	2	60	2	42	C
<i>Microlaena stipoides</i>	2	50	2	34	C
<i>Poa labillardierei</i>	2	40	2	10	C
<i>Themeda australis</i>	1	50	2	21	C

Threatened communities: Nil.

Equivalent vegetation types: This community has no equivalent Forest Ecosystem (Gellie 2005), however some plots were originally part of VG82 [*Montane Acacia Fern/Herb Forest*]. It appears to have affinities with VCA 333 [*Bottlebrush riparian shrubland wetland of the northern NSW South-western Slopes and southern Brigalow Belt South bioregions*] (Benson et al. 2010).

Frequently occurring weeds: Community u181 occurs along stream channels where moist conditions and frequent flooding and grazing disturbance allow the arrival, survival and reproduction of a wide variety of exotic plants. The following exotic species were recorded from 30% or more of the plots assigned to this type: *Acetosella vulgaris* (0.60), *Avena fatua* (0.30), *Briza maxima* (0.30), *Briza minor* (0.50), *Bromus diandrus* (0.50), *Bromus hordeaceus* (0.30), *Coryza bonariensis* (0.40), *Crataegus monogyna* (0.30), *Cynara cardunculus* (0.40), *Cynosurus echinatus* (0.40), *Cyperus eragrostis* (0.40), *Dactylis glomerata* (0.30), *Hypericum perforatum* (0.80), *Hypochaeris glabra* (0.40), *Hypochaeris radicata* (0.50), *Juncus bufonius* (0.30), *Lysimachia arvensis* (0.70), *Paspalum dilatatum* (0.30), *Petrorhagia nanteuilii* (0.60), *Plantago lanceolata* (0.90), *Polycarpon tetraphyllum* (0.40), *Rosa rubiginosa* (0.60), *Rubus fruticosus* spp. agg. (0.70), *Rumex crispus* (0.40), *Sanguisorba minor* (0.30), *Sonchus asper* (0.30), *Sonchus oleraceus* (0.30), *Trifolium angustifolium* (0.40), *Trifolium arvense* (0.70), *Trifolium campestre* (0.50), *Vulpia myuros* f. *megalura* (0.70).

Threats: Unlikely to have been widely cleared. Examples on freehold land are likely to be grazed except where streambanks have been protected by fencing. The habitat of this community is moist and subject to occasional flooding disturbance and it is highly prone to invasion by riparian weeds and exotic plants of adjacent pasture lands.

Reservation status: Plots of this community sampled in the ACT were located in Bullen Range NR, Molonglo Gorge NR and Gigerline NR. None of the plots from NSW assigned to this type were located in a conservation reserve; however plot distribution suggests that it may possibly occur in a range of reserves containing suitable rocky riparian habitat including Cuumbeun NR, northern Kosciuszko NP, Hattons Corner NR and Burrinjuck NP. This community was sampled and observed in a few TSRs.

Extent of clearing: Although restricted to moist riparian habitats, the rocky substrate of this type means it is unlikely to have been widely cleared.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.



Plate u181: Community u181 on a scoured rocky bank of the Goobragandra River (plot UMC414), with a diverse array of shrubs, sedges, grasses and forbs surviving in skeletal soil pockets, dominated by *Callistemon sieberi*.

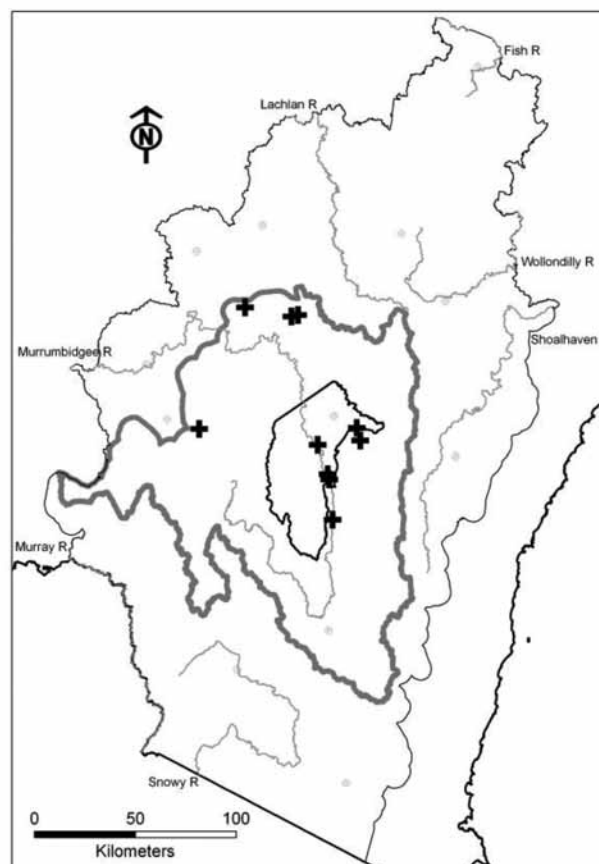


Fig. u181: Distribution of field samples assigned to this community.

Class: Inland Riverine Forests**u173: River Red Gum ± Apple Box very tall grass-forb riparian woodland on alluvial flats in the South Eastern Highlands and upper South Western Slopes bioregions**

Scientific Name: *Eucalyptus camaldulensis* ± *Eucalyptus bridgesiana* / *Carex appressa* – *Geranium solanderi* – *Themeda australis* – *Microlaena stipoides* – *Lythrum hyssopifolia*

Number of samples:	6
Richness [mean (±SD)]:	16 (10)
Slope (degrees):	(1) 2–8 (13)
Altitude (m asl):	(286) 451–570 (769)
Ave. Annual Rainfall (mm):	(643) 654–753 (867)
Temp. Annual Range (°C):	(26.6) 26.7–27.8 (27.8)

Vegetation Description: Community u173 is a woodland to open forest characterised by an open, tall to very tall canopy of *Eucalyptus camaldulensis* and/or *Eucalyptus bridgesiana* above occasional scattered tall shrubs of *Acacia deanei*. A moderately dense, moist groundlayer commonly includes patches of grasses such as *Themeda australis*, *Microlaena stipoides* and *Rytidosperma racemosum* and forbs including *Lythrum hyssopifolia*, *Geranium solanderi* and *Rumex brownii*. Streambanks and overflow pools often support tall clumps of *Carex appressa*, *Juncus gregiflorus* and *Typha domingensis*, while calmer pools and wet exposed muddy banks may contain *Myriophyllum crispatum* and other aquatic plants.

This community is found on moderately fertile alluvial flats of meandering creeks and rivers of the western tablelands and upper slopes. It has been very widely cleared and remnants are often heavily disturbed. In the current study, based on only six survey plots, it is recorded along tributaries of the upper Lachlan River (at Lade Vale, Rye Park and Wheeo Creek) and the Murrumbidgee River (sampled on Yass River flats near Murrumbateman and a Tumut River tributary at Brungle, and observed on Jugiong Creek at Childowla Road TSR).

Within its range, Community u173 may be replaced by Community u181 [*Callistemon sieberi* – *Kunzea ericoides* rocky riparian tall shrubland in the South Eastern Highlands and upper South Western Slopes bioregions] in confined reaches of streams where alluvium is reduced to skeletal pockets over bedrock. On sections of stream with increased flow velocity and sand/gravel/cobble alluvium, it may be replaced by Community p32d [*Casuarina cunninghamiana* dry forest on sand/gravel alluvial soils along major watercourses of the South Eastern Highlands and upper South Western Slopes bioregions]. On riparian flats of the lower slopes and plains to the west of the current study area, Community u173 will grade into other River Red Gum dominated communities, such as the *River Red Gum Forest* described by Mulvaney *et al.* (2005) from Gundagai Shire.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O Fid
<i>Acacia deanei</i>	1	33	1	1	P
<i>Carex appressa</i>	2	100	1	7	P
<i>Eucalyptus bridgesiana</i>	3	50	3	7	P
<i>Eucalyptus camaldulensis</i>	4	83	3	<1	P
<i>Juncus gregiflorus</i>	2	33	1	<1	P
<i>Lythrum hyssopifolia</i>	1	50	1	<1	P
<i>Myriophyllum crispatum</i>	2	33	2	<1	P
<i>Typha domingensis</i>	1	33	3	<1	P
<i>Geranium solanderi</i>	2	50	1	19	C
<i>Microlaena stipoides</i>	2	50	2	34	C
<i>Themeda australis</i>	2	50	2	21	C

Threatened communities: Nil, although it is highly rare / threatened within the region and may be eligible for listing.

Equivalent vegetation types: Plots allocated to this type include both plots within the broader analysis area classified by Gellie (2005) as VG43 [*Western Slopes Riparian Moist Sedge Woodland*], to which Community u173 has some affinities. It also has some affinities with VCA 79 [*River Red Gum shrub/grass riparian tall woodland or open forest wetland mainly in the Upper Slopes subregion of the NSW South Western Slopes bioregion and western South East Highlands bioregion*] (Benson *et al.* 2010).

Frequently occurring weeds: This community is restricted to moist, moderately fertile alluvial soils and is often heavily grazed and subject to occasional flooding disturbance, so is prone to invasion by a wide variety of exotic plant species. The following exotic plant species were recorded from 30% or more of the plots assigned to this type: *Acetosella vulgaris* (0.50), *Bromus diandrus* (0.33), *Bromus hordeaceus* (0.33), *Cirsium vulgare* (0.33), *Cynosurus echinatus* (0.50), *Holcus lanatus* (0.83), *Hypochaeris radicata* (0.50), *Lolium perenne* (0.33), *Paspalum dilatatum* (0.50), *Phalaris aquatica* (0.50), *Rosa rubiginosa* (0.33), *Rubus fruticosus* spp. agg. (0.33), *Rumex crispus* (0.33) and *Trifolium campestre* (0.33). Streambanks throughout much of the original extent of this type have been invaded by or are planted with exotic willow trees (*Salix* spp.).

Threats: The productive alluvial flats occupied by this community have been very widely cleared and converted to exotic pasture and/or are regularly cropped. Many surviving remnants are likely to be subject to ongoing stock grazing and invasion by weeds. Changes to stream hydrology in some catchments resulting from dams, changed runoff rates and bed-lowering may lead to long-term shifts in the composition of remnants of this community.

Reservation status: Only one plot assigned to this community is located in a conservation reserve (Burrinjuck NR). This community was also sampled and observed in a few TSRs.

Extent of clearing: Whilst limited in natural distribution, this community has been very widely cleared for agricultural development.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Mulvaney, M., Boak, M., Priday, S., Hudson, K. & Crane, M. (2005) The native vegetation of Gundagai shire. NSW Department of Environment and Conservation, Queanbeyan.



Plate u173: Community u173 as a narrow band of *Eucalyptus camaldulensis* over *Poa labillardierei* var. *labillardierei* and various sedges, on alluvial sediments along the Yass River at the Greenwood Road crossing (plot UMC405).

Formation: Freshwater Wetlands

Class: Montane Bogs and Fens

a9: *Carex gaudichaudiana* – *Ranunculus amphitrichus* – *Phragmites australis* aquatic herbfield of waterways in the Australian Alps and South Eastern Highlands bioregions

Scientific Name: *Carex gaudichaudiana* – *Ranunculus amphitrichus* – *Carex appressa* – *Phragmites australis* – *Hydrocotyle tripartita* – *Epilobium pallidiflorum* – *Lythrum salicaria*

Number of samples:	6
Richness [mean (±SD)]:	9 (3)
Slope (degrees):	(0) 0–1 (2)
Altitude (m asl):	(975) 978–1065 (1150)
Ave. Annual Rainfall (mm):	(772) 978–1304 (1366)
Temp. Annual Range (°C):	(24.2) 25.2–25.6 (26.5)

Vegetation Description: Community a9 is a highly variable aquatic herbfield community that, with further sampling, may represent more than one community. It includes true aquatic species with fully submerged (e.g. *Myriophyllum alpinum*), floating (e.g. *Nymphoides montana*) or emergent foliage (e.g. *Carex gaudichaudiana*), as well as semi-aquatic species capable of growing as submergents for extended periods (e.g. *Lilaeopsis polyantha*, *Lythrum salicaria*, *Montia australasica*, *Ranunculus pimpinellifolius*). *Phragmites australis* or *Carex gaudichaudiana* may fringe such vegetation. Plant cover is sporadic and sometimes only one or a few species will be present.

This community occurs in and adjacent to permanent waterways (e.g. upper reaches of the Murrumbidgee River and its tributaries), in deeper pools along intermittent streams (e.g. Nungar Creek and McPhersons Plain in NSW, Sheep Station Creek and Grassy Creek in the ACT, and in Victoria), and broad flooded creek flats (e.g. Micalong Swamp in Bondo SF).

Characteristic Species:

Species	C/A	Freq	C/A O	Freq O	Fid
<i>Carex appressa</i>	2	50	1	7	P
<i>Carex gaudichaudiana</i>	5	100	2	4	P
<i>Epilobium pallidiflorum</i>	2	33	2	<1	P
<i>Hydrocotyle tripartita</i>	3	33	2	<1	P
<i>Lilaeopsis polyantha</i>	1	33	2	<1	P
<i>Lythrum salicaria</i>	2	33	2	<1	P
<i>Montia australasica</i>	2	33	1	1	P
<i>Myriophyllum variifolium</i>	2	33	1	<1	P
<i>Phragmites australis</i>	2	50	2	<1	P
<i>Ranunculus amphitrichus</i>	3	67	1	<1	P
<i>Ranunculus pimpinellifolius</i>	1	33	1	1	P
<i>Stellaria angustifolia</i>	2	33	1	2	P

Threatened communities: Nil.

Equivalent vegetation types: Community 9 [*Aquatic*] (McDougall & Walsh 2007).

Frequently occurring weeds: Weeds are generally not prevalent in this community, suggesting a high degree of ecosystem stability. Even so, the moisture dependent *Holcus lanatus* (0.33), *Myosotis discolor*

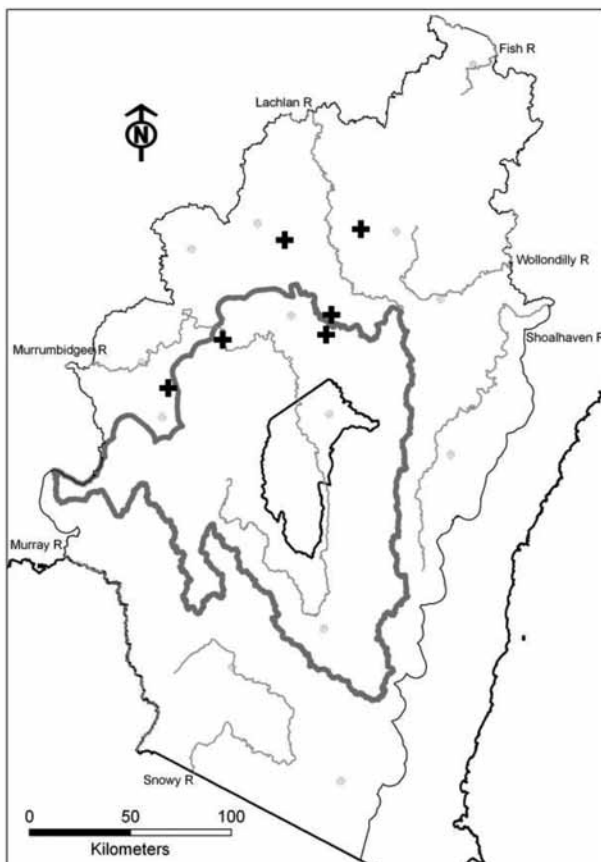


Fig. u173: Distribution of field samples assigned to this community.



Plate a9: Dense *Carex gaudichaudiana* with occasional patches containing a diversity of floating and submerged aquatic plants is typical of Community a9. In this example at Micalong Swamp (plot UMC416), patches of *Potamogeton tricarinatus* can be seen.



Plate e59: Scattered *Hakea microcarpa* and *Baeckea utilis* growing amongst *Empodisma minus* and a diversity of moisture-loving herbs is typical of Community e59, as with this example (plot UMC024B) at the headwaters of Roberts Ck, Tinderry NR.

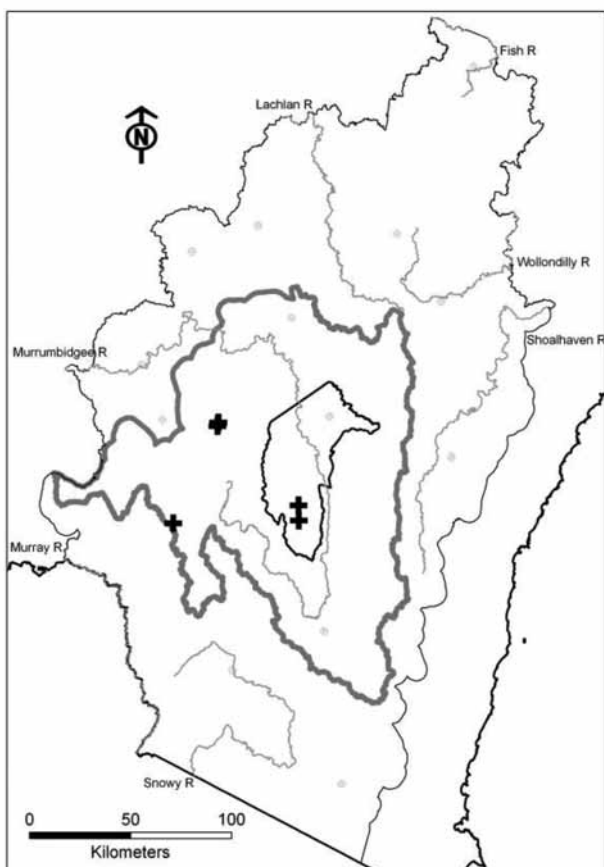


Fig. a9: Distribution of field samples assigned to this community.

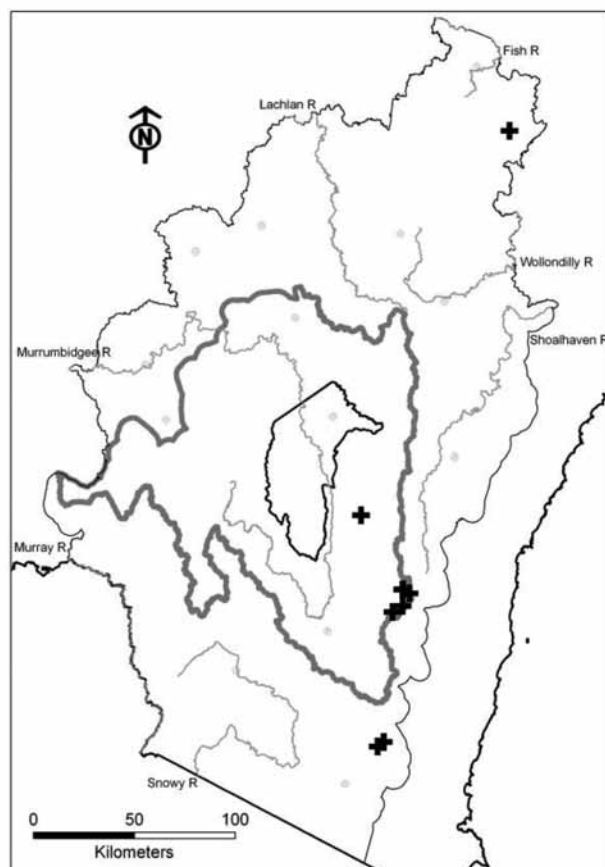


Fig. e59: Distribution of field samples assigned to this community.

(0.33) and *Myosotis laxa* subsp. *caespitosa* (0.5) were recorded in a reasonable number of plots.

Threats: Some trampling of creek edges by horses has been observed in the vicinity of this community. It is possible however that some sites formerly supporting this community have been degraded by past domestic grazing to the extent that they are no longer floristically analogous. The weed *Myosotis laxa* subsp. *caespitosa* is locally dominant in some examples (e.g. Cooleman Plain in Kosciuszko NP and McPhersons Plain east of Tumbarumba) and may threaten the integrity of this community. Flood events and drought presumably lead to great fluctuation in species composition over time. The effect of deliberate large releases of water for environmental flows from Tantangara Dam is unknown but worth investigating, as the community is well developed below the dam. The establishment of commercial timber plantations in the catchment of these sites also has the potential to compromise their hydrology.

Reservation status: Present in Kosciuszko NP and Namadgi NP, with non-reserved examples being on State Forest and freehold land.

Extent of clearing: Unknown.

References: McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

e59: *Hakea microcarpa* – *Baeckea utilis* – *Leptospermum myrtifolium* subalpine wet heathland on escarpment and eastern tableland ranges of the South Eastern Highlands bioregion

Scientific Name: *Hakea microcarpa* – *Baeckea utilis* – *Leptospermum myrtifolium* – *Epacris breviflora* / *Empodisma minus* – *Hydrocotyle sibthorpioides* – *Baloskion australe* – *Hypericum japonicum*

Number of samples:	10
Richness [mean (±SD)]:	28 (7)
Slope (degrees):	(0) 1–4 (6)
Altitude (m asl):	(937) 953–1059 (1187)
Ave. Annual Rainfall (mm):	(747) 958–1047 (1082)
Temp. Annual Range (°C):	(22.6) 23.6–24.2 (25)

Vegetation Description: Community e59 is a sub-alpine bog heathland characterised by an open (to occasionally closed) shrub stratum to approximately 1.5 metres tall, commonly dominated by *Baeckea utilis*, *Leptospermum myrtifolium* and *Epacris paludosa* and comprising many other species commonly found in the community of similar landscape position in the Australian Alps bioregion [i.e. Community a2: *Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)], such as *Carex gaudichaudiana*, *Epacris breviflora*, *Empodisma minus*, *Luzula modesta* and *Oreomyrrhis ciliata*. *Sphagnum cristatum* often occurs as isolated clumps beneath shrubs or at the margins where a permanent supply of water permits. The community is often fringed by eucalypts (e.g. *Eucalyptus dalrympleana*, *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus stellulata*), and moisture-loving grasses such as *Poa labillardierei* may be locally abundant.

This community occurs on peats and humified peat soils developed on alluvium in the bottoms of broad, flat valleys along the Great Dividing Range and coastal escarpment ranges. It may extend westward into the ACT (G. Baines, ACT ESDD, pers. comm.).

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O	Fid
<i>Allittia cardiocarpa</i>	1	30	1	<1		P
<i>Asperula gunnii</i>	2	50	1	5		P
<i>Baeckea utilis</i>	3	70	2	1		P
<i>Baloskion australe</i>	3	60	1	2		P
<i>Brachyscome scapigera</i>	2	30	1	2		P
<i>Carex</i> spp.	3	30	1	2		P
<i>Cotula alpina</i>	1	50	1	1		P
<i>Craspedia variabilis</i>	2	50	1	5		P
<i>Empodisma minus</i>	3	80	2	3		P
<i>Epacris breviflora</i>	2	50	1	2		P
<i>Epacris microphylla</i>	2	20	1	1		P
<i>Epacris paludosa</i>	2	40	2	1		P
<i>Geranium neglectum</i>	2	40	2	2		P
<i>Gonocarpus micranthus</i>	2	40	1	2		P
<i>Hakea microcarpa</i>	2	100	1	3		P
<i>Hookerchloa hookeriana</i>	5	20	1	<1		P
<i>Hydrocotyle sibthorpioides</i>	3	80	2	4		P
<i>Hypericum japonicum</i>	2	60	1	3		P
<i>Hypoxis hygrometrica</i>	2	20	1	<1		P
<i>Juncus sarophorus</i>	2	40	1	<1		P
<i>Leptospermum continentale</i>	1	30	1	2		P
<i>Leptospermum myrtifolium</i>	2	70	1	3		P
<i>Lindsaea linearis</i>	1	20	1	<1		P
<i>Luzula modesta</i>	1	30	1	2		P
<i>Mitrasacme serpyllifolia</i>	2	60	1	<1		P
<i>Oreobolus oxycarpus</i> subsp. <i>oxycarpus</i>	3	20	1	<1		P
<i>Oreomyrrhis ciliata</i>	1	40	1	2		P
<i>Patersonia fragilis</i>	2	20	2	<1		P
<i>Ranunculus pimpinellifolius</i>	2	40	1	1		P
<i>Stackhousia viminea</i>	2	20	1	<1		P
<i>Stellaria angustifolia</i>	1	30	1	1		P
<i>Utricularia dichotoma</i>	2	20	1	<1		P
<i>Velleia montana</i>	1	40	1	<1		P
<i>Veronica subtilis</i>	2	20	1	<1		P
<i>Viola caleyanana</i>	1	30	1	<1		P
<i>Xerochrysum palustre</i>	3	20	1	1		P
<i>Euchiton japonicus</i>	1	40	1	15		C
<i>Poa labillardierei</i>	4	40	2	10		C

Threatened communities: TSC Act 1995 – *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions*.

Equivalent vegetation types: Related to FrWe59 [*Southeast Sub-alpine Bog*] (Tozer et al. 2010) and Floristic Group 4 [*Shrubby herbaceous Sphagnum peatlands*] (Whinam & Chilcott 2002).

Frequently occurring weeds: The presence of domestic stock in sites on freehold and State Forest land is the likely cause of weed invasion in the community. Many sites within the conservation reserve system were also historically grazed, with the legacy of that land management expressed through the continued presence of exotic plant species. The most commonly recorded species in this community were *Cirsium vulgare* (0.40), *Hypochaeris radicata* (0.50), *Taraxacum officinale* (0.30) and *Trifolium repens* (0.30).

Threats: Some examples on State Forest and freehold land are grazed by cattle. This community is especially sensitive to trampling damage and further degradation can be expected on these tenures. Grazing, trampling and wallowing by deer occurs on all tenures but the degree of this disturbance is unknown. Frequent burning may destroy this community by damaging *Sphagnum* and peats, which causes drying of the soil and is likely to lead to the establishment of species more commonly found on drier sites. Rooting by feral pigs disturbs the groundlayer, and is associated with declining local populations of some species as well as the incursion of exotic plant species.

Reservation status: Likely to be approximately evenly distributed in National Parks and Nature Reserves, State Forest and freehold. Recorded from survey plots in Badja Swamps NR, Deua NP, Kanangra-Boyd NP and South East Forest NP.

Extent of clearing: Tozer *et al.* (2010) indicate that about 70% of this community has been cleared or heavily degraded by grazing.

References: Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406; Whinam, J. & Chilcott, N. (2002) Floristic description and environmental relationships of *Sphagnum* communities in NSW and the ACT and their conservation management. *Cunninghamia* 7:463–500.

u193: *Hakea microcarpa* – *Epacris breviflora* – *Epacris paludosa* subalpine wet heathland of the Australian Alps and western South Eastern Highlands bioregions

Scientific Name: *Eucalyptus camphora* subsp. *humeana* / *Hakea microcarpa* – *Epacris breviflora* – *Epacris paludosa* / *Empodisma minus* – *Carex gaudichaudiana* – *Asperula gunnii* – *Gonocarpus micranthus*

Number of samples:	14
Richness [mean (±SD)]:	28 (7)
Slope (degrees):	(0) 1–8 (13)
Altitude (m asl):	(790) 1002–1188 (1439)
Ave. Annual Rainfall (mm):	(847) 936–1331 (1495)
Temp. Annual Range (°C):	(23) 23.8–25.6 (26)

Vegetation Description: Community u193 is a swampy heathland to 2 metres in height, typically dominated by *Baeckea utilis*, *Epacris breviflora*, *Epacris paludosa* and/or *Hakea microcarpa*. The ground cover is usually a dense cover of *Empodisma minus* and sedges (*Carex* spp., *Eleocharis* spp.) interspersed with herbs such as *Gonocarpus micranthus*, *Hydrocotyle sibthorpioides*, *Poa costiniana*, *Poa labillardierei* and *Ranunculus pimpinellifolius*. *Carex gaudichaudiana* may be abundant in areas of open water within the community. *Sphagnum cristatum* may also be present.

This community is distributed between the Brindabella Ranges and the Tumbarumba area. It is largely a treeless, shrub-dominated wetland apart from scattered or fringing *Eucalyptus camphora* subsp. *humeana* to 5 metres in height at some sites. Floristically and structurally it is similar to low altitude examples of Community a2 [*Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)], which typically occurs on broad frost hollows where it is bordered by grassland. Upslope, this community adjoins woodland or forest dominated by *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus stellulata* or *Eucalyptus dalrympleana*. Examples range in size from tens of square metres where fed by permanent springs to several hectares on flat sections of streams. Soils are peaty.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	Q	Fid
<i>Asperula gunnii</i>	2	71	1	5			P
<i>Baeckea gunniana</i>	2	21	1	1			P
<i>Baeckea utilis</i>	3	57	2	1			P
<i>Baloskion australe</i>	2	64	1	2			P
<i>Brachyscome scapigera</i>	1	21	1	2			P
<i>Carex appressa</i>	2	50	1	7			P
<i>Carex gaudichaudiana</i>	3	79	2	4			P



Plate u193: Community u193 with *Hakea microcarpa*, *Baeckea utilis* and *Carex gaudichaudiana* in Yaouk Creek Swamp, Scabby Range Nature Reserve (plot UMC421).

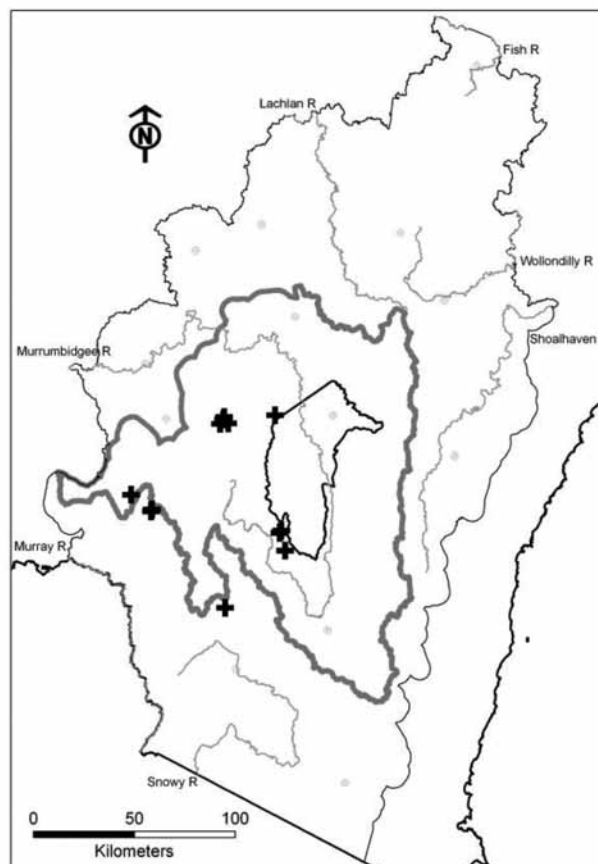


Fig. u193: Distribution of field samples assigned to this community.

<i>Comesperma retusum</i>	1	36	1	<1	P
<i>Deyeuxia gunniana</i>	2	21	1	<1	P
<i>Eleocharis gracilis</i>	2	29	2	<1	P
<i>Eleocharis sphacelata</i>	2	21	3	<1	P
<i>Empodisma minus</i>	4	71	2	3	P
<i>Epacris breviflora</i>	2	86	1	2	P
<i>Epacris paludosa</i>	3	57	2	1	P
<i>Epilobium billardierianum</i> subsp. <i>hydrophilum</i>	2	21	1	<1	P
<i>Epilobium gunnianum</i>	1	21	1	1	P
<i>Eucalyptus camphora</i> subsp. <i>humeana</i>	3	21	1	<1	P
<i>Gonocarpus micranthus</i>	2	71	1	2	P
<i>Gratiola peruviana</i>	2	29	1	1	P
<i>Hakea microcarpa</i>	2	86	1	3	P
<i>Hydrocotyle algida</i>	1	21	1	1	P
<i>Hydrocotyle sibthorpioides</i>	2	64	2	4	P
<i>Hypericum japonicum</i>	2	36	1	4	P
<i>Hypoxis hygrometrica</i>	2	21	1	<1	P
<i>Juncus falcatus</i>	1	21	1	<1	P
<i>Juncus fockei</i>	1	21	1	<1	P
<i>Lachnagrostis filiformis</i>	2	29	2	4	P
<i>Lobelia pedunculata</i>	2	29	1	5	P
<i>Lobelia surrepens</i>	2	21	2	<1	P
<i>Luzula modesta</i>	2	57	1	2	P
<i>Luzula ovata</i>	1	21	1	<1	P
<i>Myriophyllum crispatum</i>	2	21	2	<1	P
<i>Oreomyrrhis ciliata</i>	2	21	1	2	P
<i>Pimelea bracteata</i>	2	36	1	<1	P
<i>Poa costiniana</i>	2	43	2	5	P
<i>Poa labillardierei</i>	2	43	2	10	P
<i>Ranunculus pimpinellifolius</i>	1	43	1	1	P
<i>Senecio glomeratus</i>	2	21	2	<1	P
<i>Stellaria angustifolia</i>	2	43	1	1	P
<i>Veronica subtilis</i>	2	50	1	<1	P

Threatened communities: TSC Act 1995 – *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions.*

Equivalent vegetation types: Community u193 has an affinity with VG124 [*Western Montane/Sub-alpine Wet Heath/Herb Grass Woodland*] and includes western elements of VG123 [*Montane/Sub-alpine Wet Heath/Bog*] (Gellie 2005). The new community concept appears to be a largely treeless wetland (apart from scattered or fringing *Eucalyptus camphora* subsp. *humeana*) related to Community a2 [*Baeckea gunniana* – *Epacris paludosa* – *Richea continentis* – *Sphagnum cristatum* wet heathland of the Australian Alps bioregion (Bog)], which occurs mostly at higher altitude. Western examples may have some affinities with VCA 285 [*Broad-leaved Sally grass* – *sedge woodland on valley flats and swamps in the NSW South-western Slopes and adjoining South Eastern Highlands bioregions*] (Benson et al. 2010).

Frequently occurring weeds: Disturbance by cattle (whether historic or more recent) is the likely reason for the high frequency with which some weeds were recorded from this community. As with other freshwater wetland communities, *Holcus lanatus* (0.75), *Hypochaeris radicata* (0.50) and *Trifolium repens* (0.33) were the most frequently recorded weeds.

Threats: All examples are threatened by feral horse grazing and trampling. Cattle grazing is permitted in many State Forest examples. Although most vascular plants in this community are facultative resprouters and well-adapted to fire, *Sphagnum cristatum* and the peat soils beneath may be damaged by single fire events. Additionally, fire regimes that repeatedly cause such damage before natural recovery occurs will destroy the system through drying, which facilitates stream entrenchment and allows species of drier systems to invade. Low montane wetlands are far more susceptible to weed invasion than similar systems at high altitude. Exotic grasses such as *Holcus lanatus* can

become abundant and dominating following disturbance. Exotic *Juncus* species (e.g. *Juncus effusus*, *Juncus articulatus*) and *Salix cinerea* may be future threats to the integrity of this community.

Reservation status: Recorded in Brindabella NP, Scabby Range NR, Yaouk NR and the western edge of Kosciuszko NP, but mostly occurs in State Forest and on freehold land.

Extent of clearing: Unknown and probably negligible but all examples have a history of grazing, which is likely to have severely degraded this community.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

Class: Montane Lakes

L12: Freshwater sedge-herb marsh of shallow, commonly inundated wetlands of the eastern South Eastern Highlands bioregion

Scientific Name: *Eleocharis acuta* – *Amphibromus nervosus* – *Lachnagrostis filiformis* ± *Eleocharis pusilla* / *Glossostigma elatinoides* – *Ranunculus inundatus* – *Hydrocotyle sibthorpioides* / *Myriophyllum simulans* – *Potamogeton tricarlinatus*

Number of samples:	29
Richness [mean (±SD)]:	17 (6)
Slope (degrees):	(0) 0–1 (4)
Altitude (m asl):	(708) 773–1035 (1239)
Ave. Annual Rainfall (mm):	(530) 584–744 (879)
Temp. Annual Range (°C):	(24.1) 24.8–26.3 (26.8)

Vegetation Description: Community L12 occupies frequently-inundated wetlands and is commonly dominated by the tall emergent spike-sedge *Eleocharis acuta* accompanied by scattered *Amphibromus nervosus* and *Lachnagrostis filiformis*. A variety of other tall emergents present at varying frequency include *Eleocharis pusilla*, *Juncus australis*, *Eleocharis sphacelata* and/or *Carex tereticaulis*. Some new plots assigned to this group include *Triglochin procera* and *Glyceria australis*, at times as co-dominant emergents. A layer of low herbaceous wetland plants commonly sprawls along wetland margins, frequently dominated by *Hydrocotyle sibthorpioides*, *Glossostigma elatinoides* and *Ranunculus inundatus*, with a diversity of other low wetland forbs at lower frequencies on the margins and spreading across standing water by rhizomes or stolons. Standing water is commonly occupied by floating/submerged aquatic taxa *Myriophyllum simulans* and *Potamogeton tricarlinatus* and less commonly *Potamogeton ochreatus*, *Myriophyllum caput-medusae*, and occasionally the tiny gypsy floaters *Azolla filiculoides*, *Lemma disperma* or *Wolffia australiana*.

Community L12 is generally known from alluvium derived from a variety of substrates including basalt, granite, granodiorite and sedimentary rocks. Most samples are from Monaro lakes, in an area bounded by Cootralantra in the north, Hilltop and Ingebirah in the west, south to Bombala and east to Nimmitabel. Recent plot samples extend the range of this tableland wetland complex far to the north, with samples from Molonglo Lagoon east of Queanbeyan, along the Collector Creek chain-of-ponds system above Lake George, from swamps at Rows Lagoon and Wet Lagoon, and from Burra Burra Lake on basalt north of Taralga.

Also added to this group are plots from frequently-inundated river-flat wetlands on the Monaro – beside the Bombala River near Bibbenluka and the Murrumbidgee River east of Adaminaby.

This community is partly defined from whole-lake samples collected by Benson & Jacobs (1994) and is closely aligned with their Communities 1 and 2. The species list below is based on data from a combination of 22 whole-lake samples and seven plot samples assigned to this group.

Characteristic Species:

Species	C/A	Freq	C/A O	Freq O	Fid
<i>Amphibromus nervosus</i>	2	86	2	<1	P
<i>Brachyscome radicans</i>	2	21	1	<1	P
<i>Carex tereticaulis</i>	1	21	2	<1	P
<i>Centipeda cunninghamii</i>	2	31	3	<1	P
<i>Crassula helmsii</i>	2	38	3	<1	P
<i>Eleocharis acuta</i>	4	93	3	1	P
<i>Eleocharis pusilla</i>	3	48	2	<1	P
<i>Eleocharis sphacelata</i>	3	28	2	<1	P
<i>Euchiton sphaericus</i>	2	28	1	7	P
<i>Glossostigma elatinooides</i>	3	62	2	<1	P
<i>Hydrocotyle sibthorpioides</i>	3	72	2	4	P
<i>Isolepis platycarpa</i>	4	24	3	<1	P
<i>Juncus australis</i>	2	38	1	1	P
<i>Juncus radula</i>	2	31	1	<1	P
<i>Lachnagrostis filiformis</i>	3	83	1	4	P
<i>Limosella australis</i>	2	28	3	1	P
<i>Lobelia surrepens</i>	2	24	2	<1	P
<i>Marsilea costulifera</i>	3	34	3	<1	P
<i>Montia australasica</i>	1	24	1	1	P
<i>Myriophyllum caput-medusae</i>	3	21	3	<1	P
<i>Myriophyllum simulans</i>	4	66	2	<1	P
<i>Persicaria prostrata</i>	2	31	2	<1	P
<i>Potamogeton ochreatus</i>	2	28	3	<1	P
<i>Potamogeton tricarlinatus</i>	3	79	4	<1	P
<i>Ranunculus diminitus</i>	2	24	3	1	P
<i>Ranunculus inundatus</i>	2	76	1	<1	P
<i>Stellaria angustifolia</i>	1	24	1	1	P



Plate L12: Community L12 on Molonglo Lagoon north of Hoskinstown (plot UMC419) dominated by *Eleocharis acuta* and *Schoenoplectus pungens* over floating/submerged aquatic species.

Threatened communities: EPBC Act 1999 – *Upland Wetlands of the New England Tablelands and the Monaro Plateau.*

Equivalent vegetation types: This community represents a revision of marsh communities 1 and 2 [*Shallow freshwater sedge-herb marshes*] identified by Benson & Jacobs (1994), with the extension of this combined type to the north with the addition of wetland plot samples from the broader Southern Tablelands, and into floodplain marshes. This community is related to FrWp57 [*Tableland Swamp Meadow*] identified by Tozer *et al.* (2010).

Frequently occurring weeds: The widespread aquatic weeds *Juncus articulatus* (0.45) and *Rumex crispus* (0.48) were the most common weeds observed in this community.

Threats: These shallow herbaceous tableland wetlands exist in specialised habitats of concentrated moisture and nutrients with high agricultural productivity potential. As such they have been subject to widespread, intensive disturbances including draining, exotic pasture introductions, heavy stock grazing and cropping. Remaining undrained examples located within highly modified rural catchments may be subject to increased frequency of eutrophication and invasion by exotic plants at various stages of their wetting/drying cycles.

Reservation status: No records of this community occur on conservation reserves.

Extent of clearing: The original extent of these herbaceous wetlands is likely to have been greatly reduced across their range by widespread draining, cropping and exotic pasture establishment.

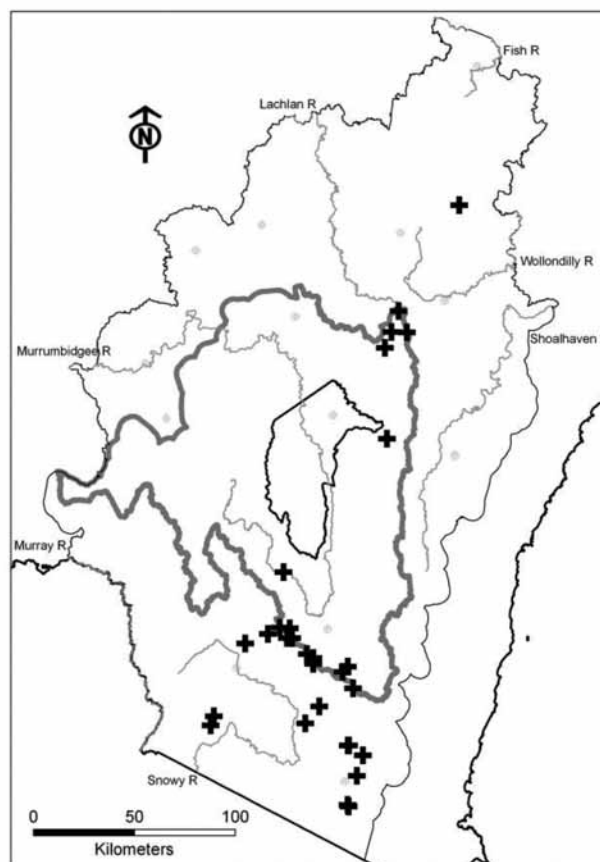


Fig. rL12: Distribution of field samples assigned to this community

References: Benson, J.S. & Jacobs, S.W.L. (1994) Plant communities of the Monaro lakes. *Cunninghamia* 3: 651–676; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

L3: Freshwater sedge-herb marsh of shallow ephemeral lakes of the eastern South Eastern Highlands bioregion

Scientific Name: *Lachnagrostis filiformis* – *Eleocharis acuta* – *Isolepis platycarpa* / *Centipeda cunninghamii* – *Limosella australis* – *Persicaria prostrata* ± *Ranunculus diminutus* / *Potamogeton ochreatus* ± *Potamogeton tricarinatus*

Number of samples:	13
Richness [mean (±SD)]:	10 (4)
Slope (degrees):	(0) 0–1 (4)
Altitude (m asl):	(744) 916–1003 (1012)
Ave. Annual Rainfall (mm):	(512) 521–586 (758)
Temp. Annual Range (°C):	(24.6) 25.5–26.6 (27.1)

Vegetation Description: Community L3 is recorded from shallow lakes formed on basalt substrates on the Monaro. Although only sampled from the Monaro, other small ephemeral wetlands matching this community may occur (or occurred prior to disturbance) further north along the tablelands, for example smaller lakes/lagoons in the Lake Bathurst and Breadalbane areas.

This community is recorded from lakes which are generally small in area, shallow and ephemeral (“probably dry for most of the year” – Benson & Jacobs 1994), and some may be moderately saline. Common dominant native plants are ubiquitous, resilient perennial wetland species including the tufted plants *Eleocharis acuta*, *Lachnagrostis filiformis* and *Isolepis platycarpa*, prostrate forbs such as *Centipeda cunninghamii*, *Limosella australis* and *Persicaria prostrata*, and the highly vagile annual aquatic pondweed *Potamogeton ochreatus*. These wetlands tend to have relatively low native species richness.

Community L3 is defined entirely from whole-lake samples collected by Benson & Jacobs (1994) and therefore is closely aligned with Community 3 as described in that study.

Characteristic Species:

Species	C/A	Freq	C/A O	Freq O	Fid
<i>Amphibromus nervosus</i>	3	31	2	<1	P
<i>Carex bichenoviana</i>	2	23	3	<1	P
<i>Centipeda cunninghamii</i>	3	92	2	<1	P
<i>Crassula helmsii</i>	2	38	3	1	P
<i>Eleocharis acuta</i>	2	77	3	2	P
<i>Eleocharis pusilla</i>	3	31	2	<1	P
<i>Glossostigma elatinooides</i>	2	23	3	<1	P
<i>Isolepis platycarpa</i>	3	77	3	<1	P
<i>Lachnagrostis filiformis</i>	3	100	2	4	P
<i>Limosella australis</i>	2	77	3	1	P
<i>Marsilea costulifera</i>	5	31	2	<1	P
<i>Myriophyllum verrucosum</i>	4	31	3	<1	P
<i>Persicaria prostrata</i>	2	54	2	<1	P
<i>Potamogeton ochreatus</i>	3	54	2	<1	P
<i>Potamogeton tricarinatus</i>	4	46	3	<1	P
<i>Puccinellia stricta</i>	2	23	2	<1	P
<i>Ranunculus diminutus</i>	3	38	2	1	P



Plate L3: An inundated example of Community L3 in a basalt depression on Maffra Road approximately 16 km south of Cooma. This photo was taken in the same location as plot MWP166, although almost 20 years later.

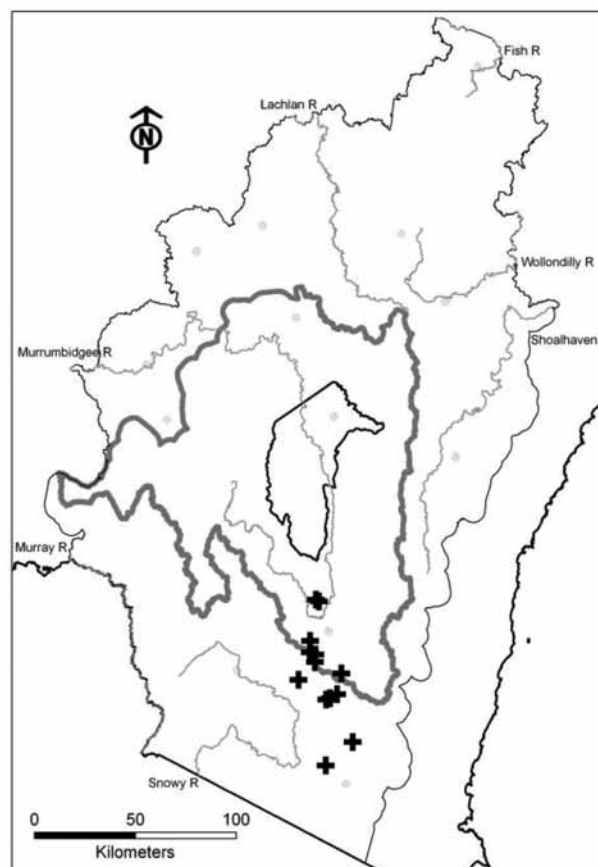


Fig. L3: Distribution of field samples assigned to this community.



Plate L4: Community L4 on the Little Morass, adjoining the Morass and Lake Bathurst, with the drying lake margin supporting a diverse suite of wetland and moist edge species (plot KT_LAKBB).

Threatened communities: EPBC Act 1999 – *Upland Wetlands of the New England Tablelands and the Monaro Plateau*.

Equivalent vegetation types: Equivalent to Community 3 [*Shallow ephemeral freshwater herb-grass marsh*] of Benson & Jacobs (1994).

Frequently occurring weeds: The weed species recorded from within this community are typical of degraded moist-terrestrial and ephemeral-aquatic environments, and include *Holcus lanatus* (0.31), *Persicaria maculosa* (0.31), *Rumex crispus* (0.23) and *Veronica anagallis-aquatica* (0.23).

Threats: These ephemeral herbaceous tableland lakes are specialised habitats of concentrated moisture and nutrients with high agricultural productivity potential, so have been subject to widespread, intensive disturbances equivalent to clearing including draining, exotic pasture plant introductions, heavy stock grazing and cropping. Remaining undrained examples located within highly modified rural catchments may be subject to increased frequency of eutrophication and invasion by exotic plants at various stages of their wetting/drying cycles.

Reservation status: No records of this community occur on conservation reserves.

Extent of clearing: The original extent of these herbaceous wetlands is likely to have been greatly reduced across their range by widespread draining, cropping and exotic pasture establishment.

Reference: Benson, J.S. & Jacobs, S.W.L. (1994) Plant communities of the Monaro lakes. *Cunninghamia* 3: 651–676.

L4: Freshwater sedge-herb marsh of deep semi-permanent and/or slightly saline wetlands of the eastern South Eastern Highlands bioregion

Scientific Name: *Lachnagrostis filiformis* – *Carex bichenoviana* – *Eleocharis acuta* ± *Eleocharis pusilla* / *Ranunculus diminutus* – *Limosella australis* – *Crassula helmsii* ± *Persicaria prostrata* / *Lepilaena bilocularis*

Number of samples:	32
Richness [mean (±SD)]:	13 (5)
Slope (degrees):	(0) 0–0 (4)
Altitude (m asl):	(672) 874–987 (1165)
Ave. Annual Rainfall (mm):	(505) 531–650 (799)
Temp. Annual Range (°C):	(24.5) 25.7–26.7 (27.6)

Vegetation Description: Tableland lakes containing community L4 are generally large in area, deep and contain permanent water (“rarely dry”) (Benson & Jacobs 1994). Some are moderately saline at least during drying phases. Common native species of these wetlands and their margins include tall emergents *Eleocharis acuta*, *Carex bichenoviana*, *Lachnagrostis filiformis* and *Juncus vaginatus*, a mixed low forbs layer including *Crassula helmsii*, *Limosella australis*, *Ranunculus diminutus* and *Persicaria prostrata*, and aquatic taxa commonly dominated by the submerged *Lepilaena bilocularis*.

This community occurs on alluvium derived from a variety of substrates including basalt, granite, granodiorite and sedimentary rocks. Monaro Lake samples range from Dangelong, Bililingra and Dry Plain in the north, southwest to Cootralantra, Hill Top and Moonbah, and east to Bungarby, Bibbenluke and Rock Flat. Recent plot samples from the Morass and Little Morass (beside Lake Bathurst) extend the range of this wetland complex far to the north. This type may also occur on other large but currently unsampled tableland lakes including some of those in the Breadalbane area.

Community L4 is largely defined from whole-lake samples collected by Benson & Jacobs (1994) and is closely aligned with Community 4 as described in that study. The species list below is based on data from a combination of 29 whole-lake samples and three plot samples assigned to this group.

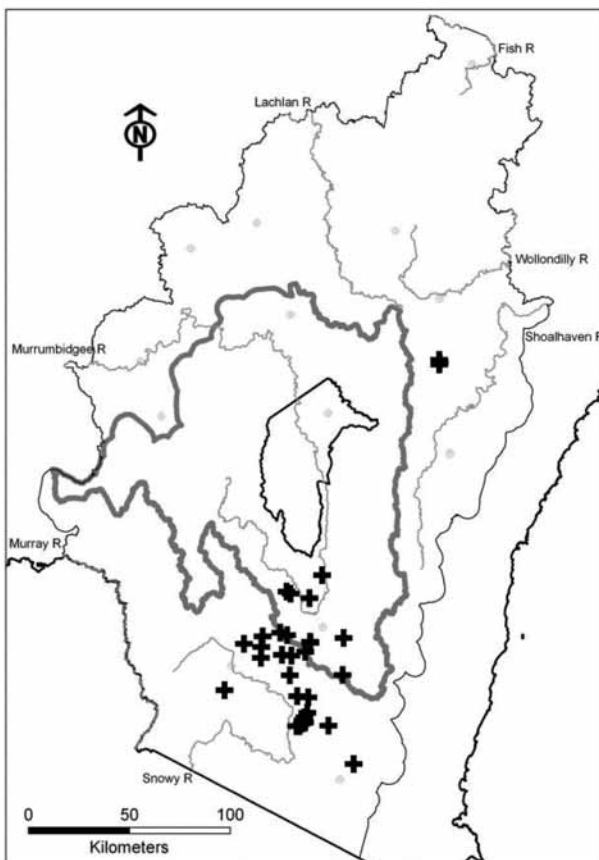


Fig. L4: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Carex bichenoviana</i>	3	84	2	<1	P
<i>Carex tereticaulis</i>	3	34	1	<1	P
<i>Chenopodium glaucum</i>	2	31	3	<1	P
<i>Crassula helmsii</i>	3	75	2	<1	P
<i>Eleocharis acuta</i>	3	72	3	1	P
<i>Eleocharis pusilla</i>	2	41	2	<1	P
<i>Hydrocotyle sibthorpioides</i>	2	25	2	4	P
<i>Isolepis platycarpa</i>	3	22	3	<1	P
<i>Juncus australis</i>	1	25	1	1	P
<i>Juncus vaginatus</i>	1	38	1	<1	P
<i>Lachnagrostis filiformis</i>	3	88	1	3	P
<i>Lepilaena bilocularis</i>	4	66	0	0	P
<i>Limosella australis</i>	3	84	2	<1	P
<i>Myriophyllum verrucosum</i>	3	22	2	<1	P
<i>Persicaria prostrata</i>	2	44	2	<1	P
<i>Potamogeton ochreateus</i>	3	28	3	<1	P
<i>Puccinellia stricta</i>	2	34	2	<1	P
<i>Ranunculus diminutus</i>	3	97	2	<1	P
<i>Schoenoplectus pungens</i>	2	25	2	<1	P

Threatened communities: EPBC Act 1999 – *Upland Wetlands of the New England Tablelands and the Monaro Plateau.*

Equivalent vegetation types: Represents a modification and extension of Community 4 [*Deep freshwater sedge-herb marsh*] of Benson & Jacobs (1994).

Frequently occurring weeds: Common weeds of this community include those that characterise other ephemeral wetland communities in the region, and include *Cirsium vulgare* (0.16), *Juncus articulatus* (0.41), *Juncus bufonius* (0.25) and *Rumex crispus* (0.47). *Hordeum marinum* (0.5), a species unique to saline environments was also recorded within this community.

Threats: This tableland wetland type generally occupies deeper, more permanent lakes than L12 and L3, so is less prone to draining, grazing and conversion to exotic pasture or cropping. However, Benson & Jacobs (1994) reported at least one example of a large Monaro lake drained by a channel cut through an adjacent hill. Some examples of this community are located within highly modified rural catchments, and may be subject to increased frequency of eutrophication and invasion by exotic plants at various stages of their wetting/drying cycles. Climate change impacts on this community will depend on its effects on the length and frequency of inundation of these wetlands.

Reservation status: No records of this community occur on conservation reserves.

Extent of clearing: The original extent of these herbaceous wetlands is likely to have been greatly reduced across their range by widespread draining, cropping and exotic pasture establishment.

Reference: Benson, J.S. & Jacobs, S.W.L. (1994) Plant communities of the Monaro lakes. *Cunninghamia* 3: 651–676.

Formation: Grassy Woodlands**Class: Subalpine Woodlands****a34: Weeping Snow Gum shrub-grass open woodland of the Australian Alps bioregion**

Scientific Name: *Eucalyptus lacrimans* / *Hakea microcarpa* – *Pimelea linifolia* subsp. *caesia* / *Poa phillipsiana*

Number of samples:	6
Richness [mean (±SD)]:	25 (1)
Slope (degrees):	(1) 3–11 (16)
Altitude (m asl):	(1241) 1321–1351 (1416)
Ave. Annual Rainfall (mm):	(1012) 1089–1251 (1499)
Temp. Annual Range (°C):	(23.2) 23.7–24 (24.6)

Vegetation Description: Community a34 is mid-high open woodland with a very sparse canopy dominated by *Eucalyptus lacrimans* to a height of about 5 metres. The understorey ranges from grass-dominated (most commonly *Poa phillipsiana*) to shrub-dominated (mostly *Hakea microcarpa*). Several species that are uncommon on the treeless plains of Kosciuszko NP were recorded in this community including *Daviesia ulicifolia*, *Dichelachne rara*, *Grevillea lanigera*, *Lepidosperma curtisiae*, *Lomandra longifolia* var. *exilis*, *Phebalium squamulosum* subsp. *ozothamnoides* and *Tetratheca bauerifolia*.

This community occurs only in Kosciuszko NP on isolated knolls and low ridges of frost hollows between Long and Nungar Plains in Kosciuszko NP (including the Kiandra area and Currango Plain). It is especially prominent on the slopes of the Murrumbidgee River at Gulf Bend, below Tantangara Dam. This community is considered distinct from vegetation containing *Eucalyptus lacrimans* around Adaminaby, where the understorey is dominated by *Themeda australis* and contains many elements of the Monaro Plains grassland communities such as Community r6 [*Dry Tussock Grassland of the Monaro in the South Eastern Highlands bioregion*]. Further sampling is required to quantify the existence of this plant community.

Characteristic Species:

Species	C/A	Freq	C/A O	FreqO	Fid
<i>Acrothamnus hookeri</i>	1	67	1	8	P
<i>Asperula gunnii</i>	1	67	1	5	P
<i>Austrostipa nivicola</i>	2	33	1	<1	P
<i>Bossiaea foliosa</i>	2	50	2	4	P
<i>Carex breviculmis</i>	1	83	1	13	P
<i>Craspedia coolaminica</i>	1	50	1	2	P
<i>Craspedia jamesii</i>	1	83	1	4	P
<i>Dillwynia prostrata</i>	3	33	3	<1	P
<i>Eucalyptus lacrimans</i>	2	83	3	<1	P
<i>Geranium antrorsum</i>	1	50	1	3	P
<i>Hakea microcarpa</i>	1	100	1	3	P
<i>Hovea</i> aff. <i>heterophylla</i> (Kiandra)	1	33	1	<1	P
<i>Leptorhynchus squamatus</i>	1	33	1	3	P
<i>Linum marginale</i>	1	33	1	1	P
<i>Microseris lanceolata</i>	1	67	1	7	P
<i>Olearia myrsinoides</i>	1	33	1	<1	P
<i>Pimelea linifolia</i>	1	100	1	8	P
<i>Poa clivicola</i>	2	50	3	2	P
<i>Poa phillipsiana</i>	2	83	3	3	P
<i>Poranthera microphylla</i>	1	83	1	27	P
<i>Ranunculus graniticola</i>	1	67	1	4	P
<i>Rytidosperma</i> spp.	1	50	1	7	P
<i>Scleranthus biflorus</i>	1	67	1	10	P



Plate a34: *Eucalyptus lacrimans* is a sparse dominant of Community a34, which is confined to Kosciuszko NP (this example at Long Plain). The understorey may be shrubby or grassy.

<i>Scleranthus fasciculatus</i>	2	33	1	1	P
<i>Senecio pinnatifolius</i> var. <i>alpinus</i>	1	33	1	3	P
<i>Trisetum spicatum</i>	1	83	1	3	P
<i>Elymus scaber</i>	1	50	1	21	C
<i>Styliidium graminifolium sens. lat</i>	1	50	1	25	C

Threatened communities: Nil.

Equivalent vegetation types: Community 34 [*Eucalyptus lacrimans* low open woodland] (McDougall & Walsh 2007).

Frequently occurring weeds: The weeds *Acetosella vulgaris* (0.50), *Cerastium vulgare* (0.33) and *Hypochaeris radicata* (0.67) are the most frequently recorded from this community, indicating past grazing disturbance.

Threats: The majority of sites contain dead trees of *Eucalyptus lacrimans*, with little or no recruitment of this species. The reason for the decline of the over-storey warrants investigation, but may be attributed in some way to the recent extended drought. This community is also highly localized, making it vulnerable to stochastic disturbance events.

Reservation status: Entirely within Kosciuszko NP.

Extent of clearing: Unknown. Large areas of *Eucalyptus pauciflora* subsp. *pauciflora* were cleared in the vicinity of this community in the early 20th Century to increase the grazing capacity of the land. The sparse nature of *Eucalyptus lacrimans* stands may have saved it from that fate.

Reference: McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1–57.

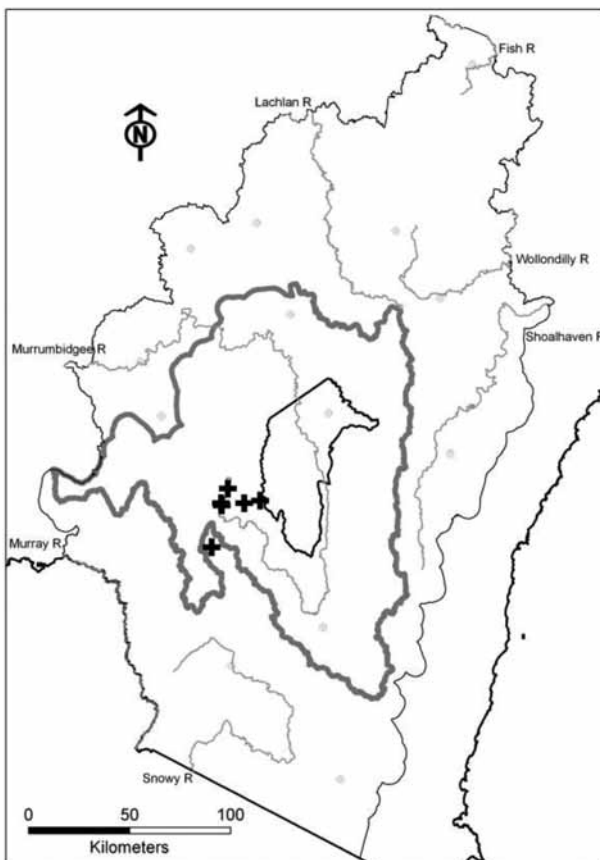


Fig. a34: Distribution of field samples assigned to this community.

u22: Mountain Gum – Snow Gum ± Robertson's Peppermint grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions

Scientific Name: *Eucalyptus dalrympleana* – *Eucalyptus pauciflora* subsp. *pauciflora* ± *Eucalyptus radiata* subsp. *robertsonii* / *Acacia dealbata* / *Poa sieberiana* – *Stellaria pungens* – *Viola betonicifolia* – *Lomandra longifolia*

Number of samples:	224
Richness [mean (±SD)]:	39 (11)
Slope (degrees):	(0) 6–16 (35)
Altitude (m asl):	(462) 1109–1294 (1694)
Ave. Annual Rainfall (mm):	(701) 1075–1326 (1688)
Temp. Annual Range (°C):	(22.2) 23.7–24.7 (28.2)

Vegetation Description: Community u22 is a very tall grassy woodland to open forest dominated by *Eucalyptus dalrympleana* and *Eucalyptus pauciflora* subsp. *pauciflora*, occasionally with *Eucalyptus radiata* subsp. *robertsonii*. The shrub layer is generally sparse or absent with minor occurrences of *Acacia dealbata*, *Coprosma hirtella*, *Olearia erubescens* and *Platylobium montanum*. The understorey is characterised by a dense grassy / herbaceous cover, and is usually dominated by *Poa sieberiana*, infrequently with *Dichelachne sieberiana* or *Rytidosperma pallidum*. Common forbs include *Stellaria pungens*, *Viola betonicifolia*, *Lomandra longifolia*, *Acaena novae-zelandiae*, *Asperula scoparia*, *Glycine clandestina*, *Clematis aristida*, *Styliidium graminifolium sens. lat.*, *Poranthera microphylla*, *Coronidium scorpioides* and *Wahlenbergia stricta*.

This community is distributed from south of Batlow in the Bago-Maragle area, through northern Kosciuszko, Brindabella and Namadgi NPs, and extending eastwards to the Tinderry Ranges. It is found mainly on sandy-loam soils derived from granitoids. It grades into Community u239 [*Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open*

forest of the Australian Alps and South Eastern Highlands bioregions] except in the Tinderry Ranges where it often grades into u150 [*Broad-leaved Peppermint – Mountain Gum tall grass-forb open forest of the South Eastern Highlands and Australian Alps bioregions*]. In the Brindabella ranges, it may grade into Community u52 [*Ribbon Gum – Robertson’s Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and northern Australian Alps bioregions*] on sheltered slopes, and Community u27 [*Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion*] in frost hollows downslope.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O Fid
<i>Acacia dealbata</i>	2	58	2	24	P
<i>Acacia melanoxylon</i>	1	24	1	13	P
<i>Acacia pravissima</i>	1	8	1	<1	P
<i>Acaena echinata</i>	1	20	1	8	P
<i>Acaena novae-zelandiae</i>	2	74	1	24	P
<i>Acrothamnus hookeri</i>	1	25	1	7	P
<i>Acrotriche serrulata</i>	1	23	1	10	P
<i>Arthrochilus huntianus</i>	1	2	1	<1	P
<i>Arthropodium milleflorum</i>	1	29	1	7	P
<i>Arthropodium Snowy R. catchment</i>	2	17	2	<1	P
<i>Asperula scoparia</i>	2	75	1	18	P
<i>Brachyscome aculeata</i>	1	9	1	2	P
<i>Brachyscome spathulata</i>	1	41	1	9	P
<i>Bulbine bulbosa</i>	1	13	1	4	P
<i>Caladenia alpina</i>	1	3	1	<1	P
<i>Caladenia gracilis</i>	1	4	1	1	P
<i>Calotis scabiosifolia</i> var. <i>integrifolia</i>	1	12	1	2	P
<i>Carex breviculmis</i>	2	26	1	12	P
<i>Cassinia aculeata</i>	2	37	1	12	P
<i>Chiloglottis valida</i>	2	16	1	2	P
<i>Clematis aristata</i>	1	72	1	20	P
<i>Coprosma hirtella</i>	1	52	1	9	P
<i>Coronidium scorpioides</i>	1	55	1	17	P
<i>Craspedia</i> spp.	2	16	1	3	P
<i>Craspedia variabilis</i>	1	39	1	3	P
<i>Cullen tenax</i>	2	4	1	<1	P
<i>Cymbonotus preissianus</i>	1	24	1	5	P
<i>Cynoglossum australe</i>	1	10	1	3	P
<i>Daviesia latifolia</i>	2	33	2	5	P
<i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>	3	23	2	8	P
<i>Daviesia ulicifolia</i>	2	31	1	9	P
<i>Deyeuxia monticola</i>	2	22	1	4	P
<i>Deyeuxia quadriseta</i>	1	11	1	4	P
<i>Deyeuxia rodwayi</i>	1	7	2	<1	P
<i>Dianella tasmanica</i>	1	32	2	15	P
<i>Dichelachne hirtella</i>	1	4	1	1	P
<i>Dichelachne inaequiglumis</i>	2	22	2	5	P
<i>Dichelachne sieberiana</i>	2	24	2	4	P
<i>Dipodium roseum</i>	1	3	1	<1	P
<i>Dipodium</i> spp.	1	1	1	<1	P
<i>Elymus scaber</i>	2	33	1	20	P
<i>Epacris breviflora</i>	1	7	2	2	P
<i>Epilobium billardierianum</i> subsp. <i>cinereum</i>	1	19	1	4	P
<i>Eucalyptus dalrympleana</i>	3	86	2	15	P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	3	82	3	17	P
<i>Eucalyptus radiata</i> subsp. <i>robertsonii</i>	3	36	3	7	P
<i>Euchiton japonicus</i>	1	31	1	14	P
<i>Euphrasia collina</i> subsp. <i>paludosa</i>	1	9	1	2	P
<i>Euphrasia collina</i> subsp. <i>speciosa</i>	1	2	1	<1	P
<i>Exocarpos strictus</i>	1	29	1	11	P
<i>Festuca asperula</i>	1	11	1	<1	P



Plate u22: An example of Community u22 containing *Eucalyptus pauciflora* subsp. *pauciflora* with a grassy understorey dominated by *Poa sieberiana*. Plot UMCPG06, north of Brayshaw’s Hut, eastern boundary of Kosciuszko NP.

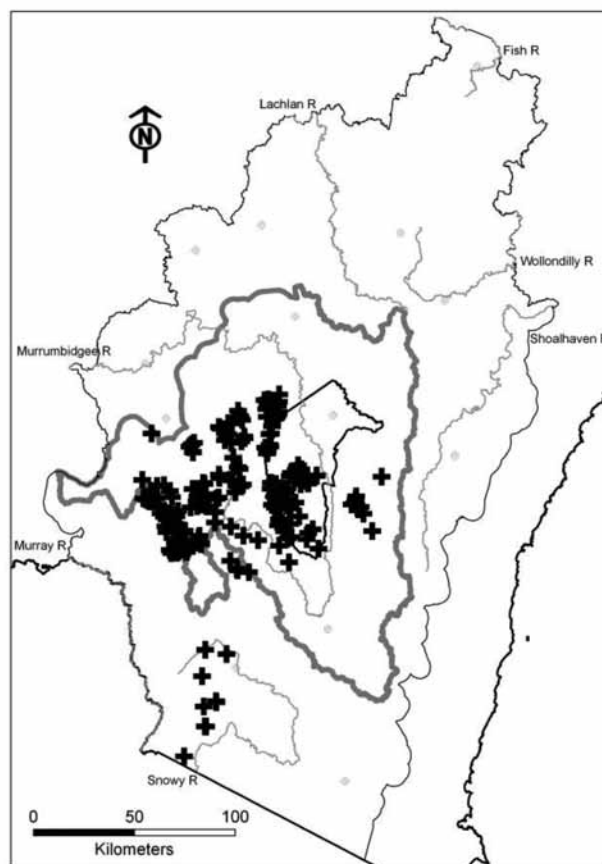


Fig. u22: Distribution of field samples assigned to this community.

<i>Galium ciliare</i>	2	5	2	<1	P
<i>Galium polyanthum</i>	1	5	1	2	P
<i>Gastrodia sesamoides</i>	1	3	1	<1	P
<i>Gentianella sylvicola</i>	1	4	1	<1	P
<i>Geranium potentilloides</i>	1	40	1	11	P
<i>Geranium solanderi</i>	1	33	1	18	P
<i>Glycine clandestina</i>	1	75	1	26	P
<i>Gonocarpus tetragynus</i>	2	48	2	48	C
<i>Hookerchloa eriopoda</i>	1	13	2	1	P
<i>Hovea asperifolia</i>	4	1	0	0	P
<i>Lachnagrostis aemula</i>	1	6	1	<1	P
<i>Lagenophora stipitata</i>	1	43	1	15	P
<i>Leptinella filicula</i>	1	14	1	2	P
<i>Leucopogon gelidus</i>	1	6	1	2	P
<i>Lobelia gibbosa</i>	1	4	1	<1	P
<i>Lobelia pedunculata</i>	1	25	1	3	P
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	1	33	1	15	P
<i>Lomandra longifolia</i>	2	78	2	40	P
<i>Lomatia myricoides</i>	1	25	1	11	P
<i>Lotus australis</i>	1	2	1	<1	P
<i>Luzula flaccida</i>	1	42	1	11	P
<i>Microseris lanceolata</i>	1	15	1	6	P
<i>Myosotis australis</i>	1	2	1	<1	P
<i>Olearia erubescens</i>	1	52	1	9	P
<i>Olearia megalophylla</i>	1	16	1	4	P
<i>Oreomyrrhis eriopoda</i>	1	42	1	11	P
<i>Ozothamnus thyrsoideus</i>	1	6	1	2	P
<i>Persoonia chamaepeuce</i>	1	41	1	9	P
<i>Persoonia subvelutina</i>	1	5	1	1	P
<i>Picris angustifolia</i>	2	10	1	1	P
<i>Platylobium montanum</i>	2	43	2	8	P
<i>Poa induta</i>	3	17	2	5	P
<i>Poa sieberiana</i>	3	88	2	45	P
<i>Poa tenera</i>	2	8	2	2	P
<i>Podolepis hieracioides</i>	1	5	1	<1	P
<i>Polyscias sambucifolia</i>	1	20	2	4	P
<i>Poranthera microphylla</i>	1	57	1	25	P
<i>Pterostylis coccina</i>	1	6	1	<1	P
<i>Pterostylis decurva</i>	1	8	1	<1	P
<i>Pterostylis fischii</i>	1	1	1	<1	P
<i>Pterostylis monticola</i>	1	12	1	<1	P
<i>Pultenaea juniperina</i>	2	4	3	<1	P
<i>Ranunculus lappaceus</i>	1	46	1	8	P
<i>Ranunculus plebeius</i>	1	10	1	3	P
<i>Ranunculus scapiger</i>	1	4	1	1	P
<i>Rytidosperma pilosum</i>	1	19	2	8	P
<i>Senecio biserratus</i>	1	3	1	<1	P
<i>Senecio diaschides</i>	1	21	1	4	P
<i>Senecio gunnii</i>	1	25	1	8	P
<i>Senecio linearifolius</i>	1	10	1	5	P
<i>Senecio prenanthoides</i>	2	38	1	18	P
<i>Stackhousia monogyna</i>	1	33	1	11	P
<i>Stellaria pungens</i>	2	88	2	27	P
<i>Stylidium graminifolium sens. lat.</i>	1	63	1	23	P
<i>Tasmannia lanceolata</i>	1	9	1	3	P
<i>Tetratelea bauertfolia</i>	1	17	1	6	P
<i>Tetratelea ciliata</i>	2	10	1	<1	P
<i>Thysanotus tuberosus</i>	1	11	1	3	P
<i>Veronica calycina</i>	1	49	1	14	P
<i>Veronica derwentiana</i>	1	35	1	5	P
<i>Veronica perfoliata</i>	1	8	1	4	P
<i>Viola betonicifolia</i>	2	85	1	23	P
<i>Wahlenbergia gloriosa</i>	1	8	1	2	P
<i>Wahlenbergia stricta</i>	1	54	1	16	P

Threatened communities: Parts of this community may contain TSC Act 1995 – *Tablelands Snow Gum*, *Black Sallee*, *Candlebark* and *Ribbon Gum Grassy Woodland in the South Eastern Highlands*, *Sydney Basin*, *South East Corner* and *NSW South Western Slopes bioregions*.

Equivalent vegetation types: This community has affinities with VG97 [*Montane Acacia Dry/ Shrub/Herb/Grass Forest*] and VG100 [*ACT Montane Dry Shrub/Grass Forest*] (Gellie 2005).

Frequently occurring weeds: Weed species were not common within this community, with only *Hypochaeris radicata* (0.66) present in the majority of sites.

Threats: Community u22 is well reserved across its range. Extensive areas also occur within the State Forest estate, where selective logging has had some impact upon the overstorey. The impact of logging is an ongoing, albeit minor threat to the floristic integrity of this community. Inappropriate fire regimes represent a greater potential threat through its capacity to alter community floristics and structure over time.

Reservation status: The majority of examples of this community are found in Kosciuszko NP and Namadgi NR, and it is also known from Bimberi NR, Brindabella NP, Burnt School NR, Scabby Range NR, Tinderry NR, Yanununbeyan NP and Yaouk NR.

Extent of clearing: Likely to be minimal. Patches closer to the valley floor are more likely to have been cleared on freehold land.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u23: Snow Gum – *Epacris breviflora* – *Leptospermum myrtifolium* tall woodland to open forest of drainage depressions primarily of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus pauciflora* subsp. *pauciflora* – *Eucalyptus dalrympleana* – *Eucalyptus stellulata* / *Epacris breviflora* – *Leptospermum myrtifolium* – *Baeckea utilis* / *Acaena novae-zelandiae* – *Stylidium graminifolium sens. lat.* – *Poa sieberiana* – *Coronidium scorpioides*

Number of samples:	17
Richness [mean (±SD)]:	44 (12)
Slope (degrees):	(1) 2–8 (17)
Altitude (m asl):	(577) 1100–1230 (1375)
Ave. Annual Rainfall (mm):	(742) 876–1235 (1423)
Temp. Annual Range (°C):	(23.8) 24–25.2 (27.8)

Vegetation Description: Community u23 is a swampy tall eucalypt woodland to open forest dominated by *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus dalrympleana* and *Eucalyptus stellulata*. The well developed shrub layer is dominated by *Epacris breviflora*, *Leptospermum myrtifolium*, *Baeckea utilis*, *Hakea microcarpa* and *Olearia erubescens*. Low shrubs include *Persoonia chamaepeuce*, *Acrothamnus hookeri*, *Acrotriche serrulata* and *Grevillea lanigera*. The diverse groundlayer is typical of subalpine woodland communities and includes *Poa sieberiana*, *Elymus scaber*, *Hookerchloa eriopoda*, *Poa helmsii*, *Acaena novae-zelandiae*, *Stylidium graminifolium sens. lat.*, *Coronidium scorpioides*, *Asperula scoparia*, *Viola betonicifolia*, *Carex appressa*, *Hydrocotyle sibthorpioides*, *Hypericum japonicum*, *Ranunculus lappaceus*, *Lomandra longifolia*, *Poranthera microphylla*, *Stellaria pungens* and *Arthropodium milleflorum*.

This is a widespread community within the study area, extending from Tallaganda NP in the east to Maragle SF in the west. The majority of plot locations occur within the central part of its range, especially in Tinderry NR, Namadgi NP and Kosciuszko NP. It is confined to sheltered locations in montane environments, generally adjacent to, or within drainage depressions. Although it is most common on granite, it also occurs on basalt and metasediments. A number of widespread montane communities occur in association with this community, including Community u22 [*Mountain Gum* – *Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern*

Highlands bioregions], Community u27 [Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion], Community u239 [Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions] and Community u150 [Broad-leaved Peppermint – Mountain Gum tall grass-forb open forest of the South Eastern Highlands and Australian Alps bioregions].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acaena novae-zelandiae</i>	2	100	1	27			P
<i>Arthropodium milleflorum</i>	1	41	1	8			P
<i>Asperula gunnii</i>	2	24	1	5			P
<i>Asperula scoparia</i>	2	59	2	22			P
<i>Baeckea utilis</i>	3	65	2	1			P
<i>Baloskion australe</i>	2	24	1	2			P
<i>Blechnum penna-marina</i> subsp. <i>alpina</i>	2	24	2	1			P
<i>Bossiaea foliosa</i>	3	24	2	4			P
<i>Brachyscome spathulata</i>	1	41	1	11			P
<i>Bulbine bulbosa</i>	2	24	1	4			P
<i>Carex appressa</i>	2	53	1	7			P
<i>Chiloglottis valida</i>	1	24	1	2			P
<i>Coronidium scorpioides</i>	2	71	1	20			P
<i>Deyeuxia quadriseta</i>	1	24	1	4			P
<i>Empodisma minus</i>	2	29	2	3			P
<i>Epacris breviflora</i>	2	94	1	2			P
<i>Eucalyptus dabrympleana</i>	2	76	3	20			P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	3	82	3	21			P
<i>Eucalyptus stellulata</i>	2	53	2	3			P
<i>Gonocarpus micranthus</i>	2	41	1	2			P
<i>Grevillea lanigera</i>	2	29	1	3			P
<i>Hakea microcarpa</i>	2	41	1	3			P
<i>Haloragis heterophylla</i>	3	24	1	2			P
<i>Hookerochloa eriopoda</i>	3	35	2	2			P
<i>Hydrocotyle sibthorpioides</i>	2	53	2	4			P
<i>Hypericum japonicum</i>	2	53	1	3			P
<i>Juncus australis</i>	2	24	1	2			P
<i>Leptospermum grandifolium</i>	3	24	3	2			P
<i>Leptospermum lanigerum</i>	4	24	2	<1			P
<i>Leptospermum myrtifolium</i>	2	88	1	3			P
<i>Olearia erubescens</i>	1	41	1	12			P
<i>Olearia megalophylla</i>	1	24	1	5			P
<i>Oxylobium ellipticum</i>	4	24	1	4			P
<i>Poa helmsii</i>	2	35	2	3			P
<i>Poa labillardierei</i>	3	35	2	10			P
<i>Ranunculus lappaceus</i>	2	53	1	11			P
<i>Rytidosperma penicillatum</i>	2	24	1	3			P
<i>Schoenus apogon</i>	2	29	1	5			P
<i>Stylidium graminifolium sens. lat.</i>	2	88	1	25			P
<i>Veronica subtilis</i>	2	24	1	<1			P
<i>Elymus scaber</i>	2	41	1	21			C
<i>Euchiton japonicus</i>	2	41	1	15			C
<i>Gonocarpus tetragynus</i>	2	41	2	48			C
<i>Lomandra longifolia</i>	1	47	2	42			C
<i>Poa sieberiana</i>	2	71	2	48			C
<i>Poranthera microphylla</i>	2	47	1	27			C
<i>Stellaria pungens</i>	2	47	2	31			C
<i>Viola betonicifolia</i>	1	59	1	27			C

Threatened communities: Parts of this community may contain TSC Act 1995 – Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions.

Equivalent vegetation types: Most similar to VG124 [Western Montane/Sub-alpine Wet Heath/Herb Grass Woodland] and VG146 [Tableland Dry Herb/Grass Woodland] (Gellie 2005).



Plate u23: Community u23 in headwaters of Little Glory Hole Creek beside Yarrangobilly Caves exit road, Kosciuszko NP, showing regenerating *Eucalyptus pauciflora* and a grass-shrub understorey.

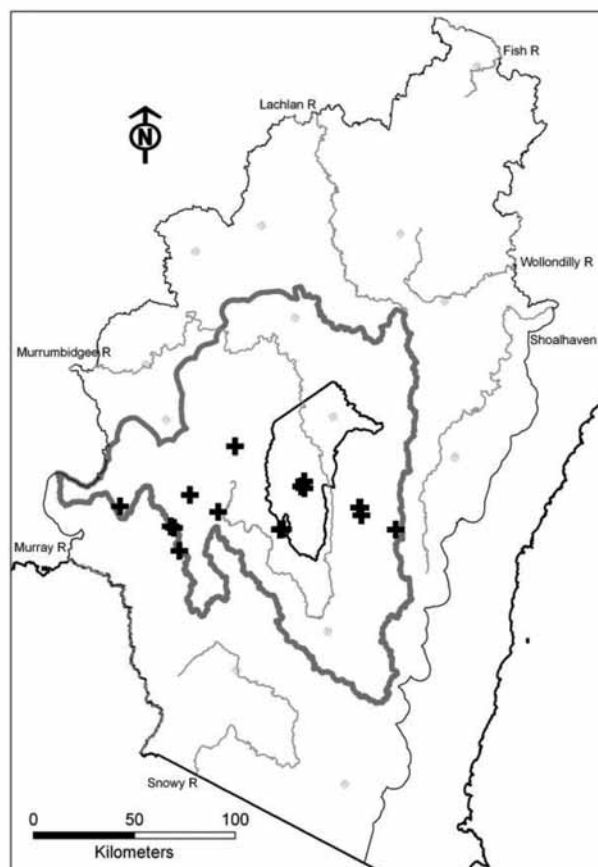


Fig. u23: Distribution of field samples assigned to this community.

Frequently occurring weeds: The weeds of this community are typical of other grassy woodlands in the South Eastern Highlands, suggesting past and possibly ongoing disturbance by grazing. This community also occurs in riparian environments, which are often subject to colonisation by weeds. The most common weeds recorded from this community include *Acetosella vulgaris* (0.23), *Centaureum erythraea* (0.23), *Cerastium vulgare* (0.31), *Crepis capillaris* (0.31), *Holcus lanatus* (0.54), *Hypochaeris radicata* (0.77), *Mimulus moschatus* (0.31), *Prunella vulgaris* (0.69), *Rosa rubiginosa* (0.23), *Trifolium dubium* (0.23) and *Trifolium repens* (0.46).

Threats: Although much of this community occurs on public land, it is not immune from disturbance or degradation. In many examples, weed invasion threatens ground and shrub layer structure and composition. Grazing by feral, and in some areas, native herbivores may exacerbate this problem. Because the community generally occurs within extensively forested regions, it is also at risk from frequent and intense fire, which may influence floristic and structural composition over time.

Reservation status: Likely to be well reserved, and is known to occur in Kosciuszko NP, Namadgi NP, Scabby Range NR, Tallaganda NP and Tinderry NR.

Extent of clearing: Negligible.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u27: Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus pauciflora* subsp. *pauciflora* – *Eucalyptus rubida* ± *Eucalyptus dives* / *Acacia dealbata* / *Poa induta* – *Poa sieberiana* – *Glycine clandestina* – *Gonocarpus tetragynus*

Number of samples:	102
Richness [mean (±SD)]:	42 (8)
Slope (degrees):	(1) 7–20 (34)
Altitude (m asl):	(890) 1088–1331 (1558)
Ave. Annual Rainfall (mm):	(656) 783–988 (1253)
Temp. Annual Range (°C):	(22.7) 24.3–25.7 (26.7)

Vegetation Description: Community u27 is a tall grassy woodland to open forest dominated by *Eucalyptus pauciflora* subsp. *pauciflora* often with *Eucalyptus rubida*, and occasionally with *Eucalyptus dives* or *Eucalyptus viminalis*. The shrub layer is generally sparse or absent with *Acacia dealbata* and *Cassinia longifolia* being the only frequently occurring shrub species, along with occasional occurrences of small shrubs such as *Acrotriche serrulata* and *Hibbertia obtusifolia*. *Daviesia ulicifolia* may be present in sites which have been burnt in the last 20–30 years. The understorey is characterised by dense grassy / herbaceous cover, and is dominated by grasses such as *Poa induta*, *Poa sieberiana*, *Elymus scaber*, *Dichelachne rara* and *Themeda australis*. Forbs include *Glycine clandestina*, *Gonocarpus tetragynus*, *Lomandra longifolia*, *Asperula scoparia*, *Viola betonicifolia*, *Stellaria pungens*, *Senecio gunnii*, *Euchiton sphaericus*, *Luzula* spp. and *Acaena novae-zelandiae*.

Plot records indicate that Community u27 is distributed mostly on mid to lower slopes on ranges and frost hollow depressions in the Namadgi region and adjacent granitic ranges. However, it is poorly sampled throughout its range and is considered to occur in the Monaro between Bredbo, Bombala and Berridale. In the Namadgi region, it generally occurs in valley floors and lower slopes associated with dry montane forests including Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*], Community u29 [*Apple Box – Broad-leaved Peppermint tall shrub-grass woodland primarily on granitoids of*



Plate u27: Community u27 with *Eucalyptus rubida*, *Eucalyptus pauciflora* and *Poa* spp. dominated grassy groundlayer near Mt Clear Camp ground track southern Naas Valley, ACT.

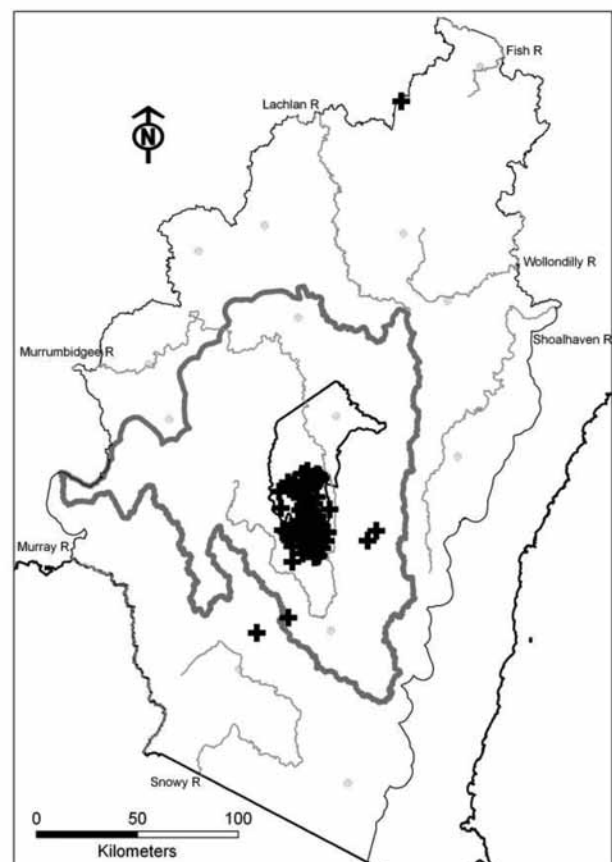


Fig. u27: Distribution of field samples assigned to this community.

the South Eastern Highlands bioregion] and Community u150 [Broad-leaved Peppermint – Mountain Gum tall grass-forb open forest of the South Eastern Highlands and Australian Alps bioregions].

This community is primarily characterised by plots sampled in the ACT. Further sampling of such vegetation in NSW will be useful to better define character species across its range.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia dealbata</i>	2	67	2	25			P
<i>Acaena novae-zelandiae</i>	1	63	1	27			P
<i>Acaena ovina</i>	1	49	1	7			P
<i>Acrothamnus hookeri</i>	1	23	1	7			P
<i>Acrotriche serrulata</i>	1	44	1	10			P
<i>Ajuga australis</i>	1	33	1	7			P
<i>Arthropodium milleflorum</i>	1	28	1	8			P
<i>Asperula scoparia</i>	2	69	2	21			P
<i>Asplenium flabellifolium</i>	1	21	1	8			P
<i>Bossiaea buxifolia</i>	1	21	1	7			P
<i>Brachyscome aculeata</i>	1	14	1	2			P
<i>Brachyscome rigidula</i>	1	11	1	2			P
<i>Brachyscome spatulata</i>	1	32	1	10			P
<i>Bursaria spinosa</i>	1	25	1	10			P
<i>Calotis scabiosifolia</i> var. <i>integrifolia</i>	1	29	1	2			P
<i>Carex inversa</i>	1	46	1	7			P
<i>Cassinia longifolia</i>	2	60	1	15			P
<i>Cassinia quinquefaria</i>	2	4	1	<1			P
<i>Chrysocephalum semipapposum</i>	1	13	1	4			P
<i>Craspedia</i> spp.	1	18	1	3			P
<i>Craspedia variabilis</i>	1	15	1	5			P
<i>Cullen microcephalum</i>	1	25	1	2			P
<i>Cymbonotus preissianus</i>	1	15	1	6			P
<i>Cymbonotus</i> spp.	1	32	1	2			P
<i>Cynoglossum australe</i>	1	25	1	3			P
<i>Cynoglossum suaveolens</i>	1	11	1	3			P
<i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>	1	31	2	9			P
<i>Daviesia ulicifolia</i>	1	26	2	10			P
<i>Deyeuxia monticola</i>	1	25	1	5			P
<i>Dichelachne micrantha</i>	1	28	1	9			P
<i>Dichelachne rara</i>	2	59	1	7			P
<i>Dichondra repens</i>	1	36	2	20			P
<i>Echinopogon cheelii</i>	1	15	1	<1			P
<i>Elymus scaber</i>	2	63	1	20			P
<i>Epilobium billardierianum</i> subsp. <i>billardierianum</i>	1	33	1	<1			P
<i>Eucalyptus dives</i>	3	36	3	18			P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	3	80	3	19			P
<i>Eucalyptus rubida</i>	3	61	3	7			P
<i>Eucalyptus stellulata</i>	3	13	2	3			P
<i>Eucalyptus viminalis</i>	3	29	3	12			P
<i>Euchiton sphaericus</i>	1	64	1	5			P
<i>Exocarpos strictus</i>	1	29	1	12			P
<i>Galium gaudichaudii</i>	1	33	1	9			P
<i>Galium polyanthum</i>	1	11	1	2			P
<i>Geranium obtusisepalum</i>	1	5	2	<1			P
<i>Geranium potentilloides</i>	2	30	1	13			P
<i>Geranium solanderi</i>	2	42	1	19			P
<i>Glycine clandestina</i>	2	82	1	28			P
<i>Gonocarpus tetragynus</i>	2	82	2	47			P
<i>Goodenia pinnatifida</i>	1	4	1	<1			P
<i>Hibbertia obtusifolia</i>	2	45	1	34			C
<i>Hovea linearis</i>	1	34	1	13			P
<i>Hypericum gramineum</i>	1	50	1	25			P
<i>Indigofera australis</i>	1	20	1	7			P
<i>Leucopogon fletcheri</i> subsp. <i>brevisepalus</i>	1	12	1	3			P

<i>Linum marginale</i>	1	6	1	1			P
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	1	36	1	15			P
<i>Lomandra longifolia</i>	2	75	2	41			P
<i>Lotus australis</i>	1	4	1	<1			P
<i>Luzula</i> spp.	1	63	1	4			P
<i>Mirbelia oxylobioides</i>	1	12	1	3			P
<i>Olearia erubescens</i>	1	25	1	12			P
<i>Oreomyrrhis eriopoda</i>	1	55	1	12			P
<i>Oxylobium ellipticum</i>	1	13	2	4			P
<i>Ozothamnus stirlingii</i>	1	6	1	<1			P
<i>Persoonia chamaepeuce</i>	1	23	1	11			P
<i>Pimelea linifolia</i>	1	31	1	8			P
<i>Pimelea treyvaudii</i>	2	10	1	<1			P
<i>Plantago varia</i>	1	57	1	10			P
<i>Poa induta</i>	3	80	2	3			P
<i>Poa sieberiana</i>	3	78	2	47			P
<i>Pultenaea procumbens</i>	1	19	1	4			P
<i>Ranunculus lappaceus</i>	1	23	1	10			P
<i>Rytidosperma penicillatum</i>	1	33	1	3			P
<i>Schoenus apogon</i>	1	15	1	5			P
<i>Scleranthus biflorus</i>	1	36	1	9			P
<i>Scleranthus diander</i>	1	20	1	1			P
<i>Senecio gunnii</i>	1	63	1	7			P
<i>Senecio quadridentatus</i>	2	21	1	5			P
<i>Solenogyne gunnii</i>	1	14	1	5			P
<i>Stackhousia monogyna</i>	1	51	1	11			P
<i>Stellaria pungens</i>	3	59	2	30			P
<i>Stylidium graminifolium</i> sens. lat.	1	50	1	25			P
<i>Themeda australis</i>	1	56	2	20			P
<i>Veronica calycina</i>	1	47	1	15			P
<i>Veronica derwentiana</i>	1	26	1	6			P
<i>Viola betonicifolia</i>	1	75	1	26			P
<i>Wahlenbergia gloriosa</i>	1	8	1	2			P
<i>Wahlenbergia graniticola</i>	1	9	2	<1			P
<i>Wahlenbergia stricta</i>	1	59	1	17			P

Threatened communities: TSC Act 1995 – *Tablelands Snow Gum*, *Black Sallee*, *Candlebark* and *Ribbon Gum Grassy Woodland* in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions.

Equivalent vegetation types: No equivalent communities, defined by plots not used in previous classifications. May have affinities with VG100 [ACT *Montane Dry Shrub/Grass Forest*] from Gellie (2005)

Frequently occurring weeds: Common weeds of the pastoral districts of the South Eastern Highlands are a feature in this community, namely *Acetosella vulgaris* (0.23), *Centaurium erythraea* (0.51), *Cirsium vulgare* (0.25), *Crepis capillaris* (0.27) and *Hypochaeris radicata* (0.67).

Threats: Widespread historic clearing of this community has resulted in it becoming severely fragmented. This in turn has resulted in a disruption to essential ecological processes and has facilitated secondary disturbances such as over-grazing, weed invasion and the incursion of feral animals. Within existing remnants, weed invasion represents a major threat to ground and shrub layer species, especially where the community occurs on freehold land subject to grazing by domestic stock, Grazing by feral, and in some areas, native herbivores has a similar effect. Where the community occurs within extensively forested areas, frequent and intense fire may affect its structural and floristic composition. Within farming districts, canopy dieback is widespread.

Reservation status: Although this community was only sampled within in the ACT Reserve system, it is distributed across large parts of the South Eastern Highlands bioregion. Many examples of this community are found in Namadgi NP but it is also known from Burnt School NR, Kosciuszko NP, Scabby Range NR, Strike-a-Light NR and Yaouk NR.

Extent of clearing: Likely to be variable, with clearing rates of this community in valley floors being considerably higher than upslope.



u28: Snow Gum – Mountain Gum – *Daviesia mimosoides* tall dry grass-shrub subalpine open forest of the Australian Alps and South Eastern Highlands bioregions

Scientific Name: *Eucalyptus pauciflora* subsp. *pauciflora* – *Eucalyptus dalrympleana* ± *Eucalyptus rubida* / *Daviesia mimosoides* subsp. *mimosoides* – *Persoonia chamaepeuce* / *Poa sieberiana* – *Stellaria pungens* – *Lomandra longifolia*

Number of samples:	54
Richness [mean (±SD)]:	24 (7)
Slope (degrees):	(0) 6–17 (42)
Altitude (m asl):	(978) 1181–1391 (1582)
Ave. Annual Rainfall (mm):	(737) 965–1129 (1587)
Temp. Annual Range (°C):	(22.3) 23.7–24.8 (25.7)

Plate u28: Community u28 at Smokers trail in Namadgi NP with *Eucalyptus dalrympleana* and *Eucalyptus pauciflora* and shrubs including *Daviesia mimosoides* and *Coprosma hirtella*.

Vegetation Description: Community u28 is a tall eucalypt woodland to open forest dominated by *Eucalyptus pauciflora* subsp. *pauciflora* and *Eucalyptus dalrympleana*. The shrubby midstorey is dominated by *Daviesia mimosoides* subsp. *mimosoides*, *Pimelea linifolia*, *Daviesia ulicifolia*, *Veronica perfoliata*, *Olearia erubescens* and *Exocarpos strictus*. Low shrubs include *Persoonia chamaepeuce*, *Hibbertia obtusifolia* and *Tetratea bauerifolia*. The diverse groundlayer shares affinities with other subalpine woodlands and includes *Poa sieberiana*, *Stellaria pungens*, *Lomandra longifolia*, *Goodenia hederacea* subsp. *hederacea*, *Stylidium graminifolium* sens. lat., *Poranthera microphylla*, *Viola betonicifolia*, *Senecio gunnii*, *Gonocarpus tetragynus* and *Asperula scoparia*.

This community is largely restricted to Namadgi NR, Kosciuszko NP and Scabby Range NR within the Australian Alps bioregion. Smaller occurrences also occur in adjacent parts of the South Eastern Highlands bioregion. It is generally confined to sheltered locations on metasedimentary and granite geologies. Communities with which Community u28 is associated are those characteristic of similar environments, including Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*], Community u27 [*Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies of the South Eastern Highlands bioregion*], Community u239 [*Alpine Ash – Mountain Gum ± Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands bioregions*] and Community u150 [*Broad-leaved Peppermint – Mountain Gum tall grass-forb open forest of the South Eastern Highlands and Australian Alps bioregions*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia obliquinervia</i>	2	17	2	3			P
<i>Bossiaea foliosa</i>	2	20	2	4			P
<i>Brachyscome spathulata</i>	1	26	1	11			P
<i>Caladenia gracilis</i>	1	17	1	1			P
<i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>	2	67	2	8			P
<i>Daviesia ulicifolia</i>	2	48	2	9			P
<i>Deyeuxia monticola</i>	1	19	1	5			P
<i>Eucalyptus dalrympleana</i>	3	65	3	19			P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	3	94	3	20			P
<i>Eucalyptus rubida</i>	2	31	3	8			P
<i>Exocarpos strictus</i>	2	31	1	12			P
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	1	67	2	16			P
<i>Grevillea lanigera</i>	2	17	1	3			P
<i>Leucopogon fletcheri</i> subsp. <i>brevisepalus</i>	1	24	1	3			P
<i>Lomandra longifolia</i>	1	74	2	42			P

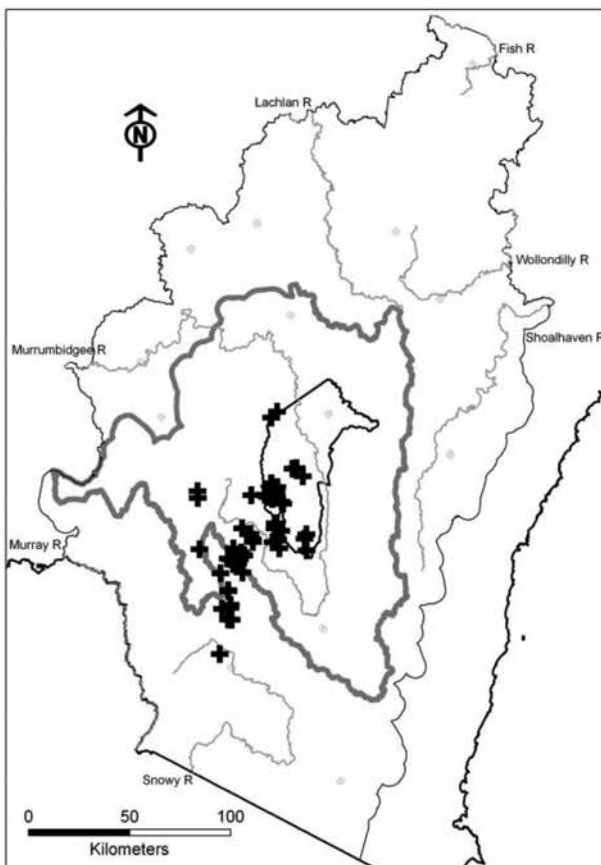


Fig. u28: Distribution of field samples assigned to this community.



Plate u118: Community u118 with *Eucalyptus stellulata* and a diverse grass/forb groundcover, near Spicers Creek firetrail east of Yarrangobilly, Kosciuszko NP (near plot UMCPG09).

<i>Lomatia myricoides</i>	1	28	1	11	P
<i>Olearia erubescens</i>	1	33	1	12	P
<i>Oxylobium ellipticum</i>	1	26	1	4	P
<i>Ozothamnus thyrsoideus</i>	1	30	1	2	PR
<i>Persoonia chamaepeuce</i>	1	67	1	10	P
<i>Pimelea linifolia</i>	1	50	1	8	P
<i>Poa sieberiana</i>	2	93	2	47	P
<i>Podolobium alpestre</i>	2	20	2	2	P
<i>Poranthera microphylla</i>	1	48	1	27	P
<i>Senecio gunnii</i>	1	33	1	9	P
<i>Stellaria pungens</i>	1	76	2	31	P
<i>Stylidium graminifolium sens. lat</i>	1	54	1	25	P
<i>Tetradlea bauerifolia</i>	1	35	1	7	P
<i>Veronica perfoliata</i>	1	33	1	4	P
<i>Hibbertia obtusifolia</i>	1	54	1	34	C
<i>Viola betonicifolia</i>	1	41	1	27	C

Threatened communities: Grassy examples of this community at lower altitudes may be the TSC Act 1995 – *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions.*

Equivalent vegetation types: Mostly defined by new plots, but may have some similarity to VG98 [*Western Montane Moist Shrub Forest*] (Gellie 2005).

Frequently occurring weeds: *Hypochaeris radicata* (0.27) is the most commonly recorded weed in this community, which probably reflects both minor past disturbance, and the colonising capacity of that species.

Threats: Although this community is largely confined to public land, the impacts of grazing by feral herbivores and inappropriate fire regimes have the potential to alter its condition.

Reservation status: This community is likely to be well reserved, with examples occurring in Brindabella SCA, Kosciuszko NP, Namadgi NP, Scabby Range NR and Yaouk NR.

Extent of clearing: Considered to be minor.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u118: Black Sallee grass-herb woodland in drainage depressions and moist valley flats in the South Eastern Highlands and Australian Alps bioregions

Scientific Name: *Eucalyptus stellulata* / *Rubus parvifolius* – *Pimelea pauciflora* / *Stellaria pungens* – *Acaena ovina* – *Asperula scoparia* – *Acaena novae-zelandiae* – *Dichondra repens* – *Poranthera microphylla*

Number of samples:	20
Richness [mean (±SD)]:	34 (7)
Slope (degrees):	(0) 3–10 (32)
Altitude (m asl):	(972) 1026–1172 (1400)
Ave. Annual Rainfall (mm):	(749) 982–1227 (1340)
Temp. Annual Range (°C):	(23.5) 25.1–25.7 (26.1)

Vegetation Description: Community u118 is a eucalypt woodland characterised by a tall canopy of *Eucalyptus stellulata*, with occasional occurrences of *Eucalyptus pauciflora* subsp. *pauciflora* and/or *Eucalyptus rubida*. A layer of low to medium shrubs may be present, as scattered individuals to dense patches, commonly including *Pimelea pauciflora*, *Epacris breviflora*, *Hakea microcarpa*, *Acacia siculiformis* and *Grevillea lanigera*. The groundlayer is generally dense to continuous, with a diverse layer of forbs and low shrubs commonly including *Acaena novae-zelandiae*, *Acaena ovina*, *Acrothamnus hookeri*,

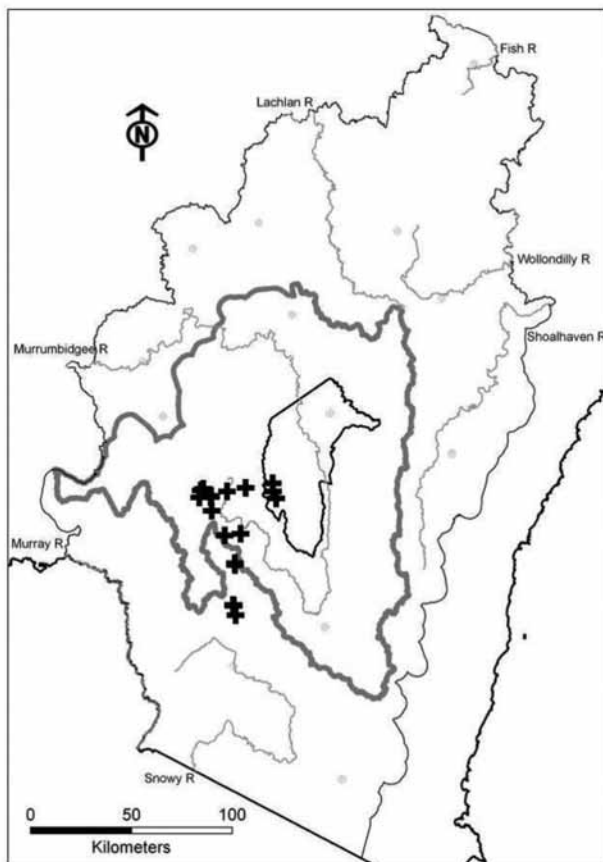


Fig. u118: Distribution of field samples assigned to this community.

Dichondra repens, *Geranium solanderi*, *Poranthera microphylla*, *Rubus parvifolius*, *Stellaria pungens*, *Themeda australis*, *Viola betonicifolia* covering the ground between tall tussocks of grasses such as *Poa sieberiana*, *Poa labillardierei*, *Poa phillipsiana*, *Poa helmsii* and sedges including *Carex appressa*.

Community u118 is recorded from moist footslopes of drainage depressions and margins of broad cold-air drainage flats on sandy soils, from the Upper Cotter area in the ACT, west to Yarrangobilly, south to Providence Portal, Eucumbene and Nimmo. It is also known to occur in areas east to Captains Flat and west into the Upper Slopes subregion of the South Western Slopes bioregion. This community is considered under-sampled across its geographic range.

In similar habitats at lower altitudes to the east of its range, this community may be replaced by Community r2 [*Poa labillardierei* – *Themeda australis* – *Juncus* sp. wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion], while in swampier sites it may grade into Community u23 [*Snow Gum* – *Epacris breviflora* – *Leptospermum myrtifolium* tall woodland to open forest of drainage depressions primarily of the South Eastern Highlands bioregion] with a greater component of moisture-loving shrubs, sedges and grasses.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	Q	Fid
<i>Acacia siculiformis</i>	2	33	1	<	1		P
<i>Acaena novae-zelandiae</i>	1	67	1		27		P
<i>Acaena ovina</i>	1	76	1		7		P
<i>Acrothamnus hookeri</i>	1	57	1		7		P
<i>Asperula scoparia</i>	1	67	2		22		P
<i>Bulbine bulbosa</i>	2	29	1		4		P
<i>Carex appressa</i>	1	48	1		7		P
<i>Carex inversa</i>	1	29	1		8		P
<i>Cullen microcephalum</i>	1	24	1		2		P
<i>Cymbonotus preissianus</i>	1	38	1		6		P
<i>Dichelachne micrantha</i>	1	33	1		10		P
<i>Dichondra repens</i>	1	62	2		20		P
<i>Epacris breviflora</i>	1	33	1		2		P
<i>Epilobium billardierianum</i> subsp. <i>cinereum</i>	2	29	1		5		P
<i>Eucalyptus rubida</i>	1	38	3		9		P
<i>Eucalyptus stellulata</i>	3	100	2		3		P
<i>Geranium antrorsum</i>	1	33	1		3		P
<i>Geranium solanderi</i>	1	48	1		19		P
<i>Geum urbanum</i>	1	24	1		<		P
<i>Grevillea lanigera</i>	2	33	1		3		P
<i>Hakea microcarpa</i>	1	38	1		3		P
<i>Luzula densiflora</i>	1	24	1		6		P
<i>Mirbelia oxylobioides</i>	1	24	1		3		P
<i>Oxylobium ellipticum</i>	2	24	1		4		P
<i>Pimelea pauciflora</i>	1	57	1		<		P
<i>Poa helmsii</i>	3	29	2		3		P
<i>Poa labillardierei</i>	1	33	2		10		P
<i>Poa phillipsiana</i>	3	24	2		3		P
<i>Poranthera microphylla</i>	1	62	1		27		P
<i>Ranunculus lappaceus</i>	1	33	1		11		P
<i>Rubus parvifolius</i>	1	62	1		11		P
<i>Scleranthus fasciculatus</i>	2	29	1		1		P
<i>Senecio gunnii</i>	1	33	1		9		P
<i>Solenogyne gunnii</i>	1	33	1		5		P
<i>Stellaria pungens</i>	1	90	2		31		P
<i>Veronica gracilis</i>	1	24	1		1		P
<i>Poa sieberiana</i>	2	57	2		48		C
<i>Themeda australis</i>	2	48	2		21		C
<i>Viola betonicifolia</i>	1	48	1		27		C

Threatened communities: TSC Act 1995 – *Tablelands Snow Gum*, *Black Sallee*, *Candlebark* and *Ribbon Gum Grassy Woodland* in the

South Eastern Highlands, *Sydney Basin*, *South East Corner* and *NSW South Western Slopes* bioregions.

Equivalent vegetation types: VCA 303 [*Black Sally grassy low woodland in valleys in the Upper Slopes subregion of the NSW South-western Slopes bioregion and western South Eastern Highlands bioregion*] (Benson et al. 2010). No obvious equivalents from other numerical classifications.

Frequently occurring weeds: This vegetation is restricted to moist footslopes and alluvial margins, a relatively productive habitat prone to invasion by a range of exotic plant taxa. Although all plots are from conservation reserves, most of these high-country areas were historically seasonally grazed, and many common pasture weeds were recorded from more than 30% of plots assigned to this community: *Acetosella vulgaris* (0.75), *Anthoxanthum odoratum* (0.30), *Centaureum erythraea* (0.30), *Cirsium vulgare* (0.60), *Crepis capillaris* (0.70), *Holcus lanatus* (0.75), *Hypochoeris radicata* (0.80), *Rosa rubiginosa* (0.35), *Taraxacum officinale* (0.35), *Trifolium campestre* (0.45), *Trifolium repens* (0.70).

Threats: Some areas of this community at lower altitudes are likely to have been drowned by water impoundments of the Snowy scheme. However, the majority of its distribution is within conservation reserves (Kosciuszko NP and Namadgi NP). Grazed examples are likely to be prone to invasion by a range of exotic pasture plants and other weeds, due to moister habitat.

Reservation status: Recorded from Namadgi NP, Kosciuszko NP and Nimmo NR but probably extending into freehold land at Snowy Plain in the Southern Rivers CMA.

Extent of clearing: Extent of clearing unknown; some examples in deeper valley floors will have been drowned by major dams.

Reference: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney.

u158: Alpine Sallee shrub-grass subalpine mid-high woodland of the Australian Alps bioregion

Scientific Name: *Eucalyptus pauciflora* subsp. *niphophila* / *Tasmannia xerophila* – *Bossiaea foliosa* – *Hovea montana* / *Stellaria pungens* – *Oreomyrris eriopoda* – *Asperula scoparia*

Number of samples:	16
Richness [mean (±SD)]:	28 (6)
Slope (degrees):	(2) 9–14 (23)
Altitude (m asl):	(1398) 1541–1634 (1907)
Ave. Annual Rainfall (mm):	(1499) 1550–1649 (1910)
Temp. Annual Range (°C):	(21.1) 22–22.2 (23)

Vegetation Description: Community u158 is a mid-high woodland dominated by *Eucalyptus pauciflora* subsp. *niphophila*. The understorey is characterised by a discontinuous, though occasionally well-developed shrub layer often to 2 metres tall, dominated by *Bossiaea foliosa*, *Tasmannia xerophila*, *Podolobium alpestre*, *Olearia phlogopappa* and *Pimelea ligustrina* subsp. *ciliata*. The groundlayer is a mix of shrubs, grasses and forbs including *Hovea montana*, *Acrothamnus hookeri*, *Acrothamnus montanus*, *Poa phillipsiana*, *Stellaria pungens*, *Asperula scoparia*, *Oreomyrris eriopoda*, *Coronidium scorpioides*, *Senecio gunnii*, *Arthropodium milleflorum*, *Carex breviculmis*, *Gonocarpus montanus*, *Goodenia hederacea* subsp. *alpestris*, *Styliidium graminifolium sens. lat* and *Microseris lanceolata*.

Community u158 is largely confined to the Australian Alps bioregion, although small areas may be present in adjacent parts of the South Eastern Highlands bioregion. The community is widespread near the altitudinal limit of trees, and may be found in the vicinity of Thredbo, Charlottes



Plate u158: Community u158 in the hills above Charlottes Pass, dominated by stunted *Eucalyptus pauciflora* subsp. *niphophila* and an understory of *Helichrysum rutidolepis*, *Olearia algida* and *Phebalium squamulosum* spp. *ozothamnoides*.

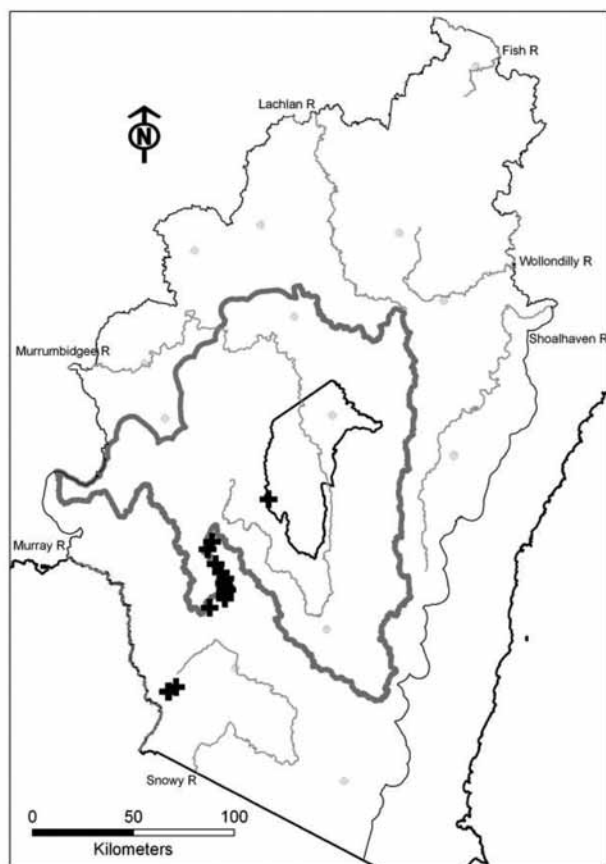


Fig. u158: Distribution of field samples assigned to this community.

Pass and Kiandra, and on the highest ranges in the ACT. It typically occurs on meta-sedimentary geologies, but is also found on granite and basalt. At its upper altitudinal limit, co-occurring communities include those typical of the alpine zone, especially Community a46 [*Prostanthera cuneata* – *Orites lancifolius* – *Nematolepis ovatifolia* heathland of the Australian Alps bioregion]. Elsewhere, the community occurs in association with Community u28 [*Snow Gum* – *Mountain Gum* – *Daviesia mimosoides* tall dry grass-shrub subalpine open forest of the Australian Alps and South Eastern Highlands bioregions] and in sheltered valleys, Community u40 [*Alpine Ash* tall wet sclerophyll open forest primarily of the Australian Alps bioregion].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acaena novae-zelandiae</i>	1	44	1	28			C
<i>Aciphylla simplicifolia</i>	1	38	1	2			P
<i>Acrothamnus hookeri</i>	1	56	1	8			P
<i>Acrothamnus montanus</i>	2	25	1	1			P
<i>Arthropodium milleflorum</i>	1	50	1	8			P
<i>Asperula scoparia</i>	1	69	2	22			P
<i>Bossiaea foliosa</i>	3	75	2	4			P
<i>Brachyscome spathulata</i>	1	44	1	11			P
<i>Brachyscome</i> spp.	1	25	1	1			P
<i>Caladenia alpina</i>	1	44	1	<1			P
<i>Carex breviculmis</i>	1	50	1	13			P
<i>Celmisia</i> spp.	2	25	1	<1			P
<i>Coronidium scorpioides</i>	2	63	1	20			P
<i>Craspedia</i> spp.	2	50	1	4			P
<i>Eucalyptus pauciflora</i> subsp. <i>niphophila</i>	3	94	2	<1			P
<i>Gonocarpus montanus</i>	1	50	1	1			P
<i>Goodenia hederacea</i> subsp. <i>alpestris</i>	1	50	2	16			P
<i>Hovea montana</i>	1	69	1	1			P
<i>Lobelia pedunculata</i>	1	44	1	5			P
<i>Luzula densiflora</i>	1	31	1	6			P
<i>Microseris lanceolata</i>	1	50	1	7			P
<i>Olearia phlogopappa</i>	2	44	1	3			P
<i>Oreomyrrhis ciliata</i>	1	31	1	2			P
<i>Oreomyrrhis eriopoda</i>	1	69	1	13			P
<i>Ozothamnus thyrsoideus</i>	1	25	1	2			P
<i>Pimelea ligustrina</i> subsp. <i>ciliata</i>	1	25	1	<1			P
<i>Poa phillipsiana</i>	3	31	2	3			P
<i>Podolepis robusta</i>	1	25	1	<1			P
<i>Podolobium alpestre</i>	1	50	2	2			P
<i>Ranunculus graniticola</i>	1	38	1	4			P
<i>Senecio gunnii</i>	1	63	1	9			P
<i>Stellaria pungens</i>	1	94	2	31			P
<i>Stylidium graminifolium</i> sens. lat	1	50	1	25			C
<i>Tasmannia xerophila</i>	2	56	1	1			P

Threatened communities: Nil.

Equivalent vegetation types: This community amalgamates VG128 [*Sub Alpine Dry Shrub/Herb Woodland*] with VG130 [*Sub-Alpine Shrub/Grass Woodland*], closely related communities previously described by Gellie (2005).

Frequently occurring weeds: The legacy of past clearing and cattle grazing is reflected in the presence and frequency with which common pastoral weeds were recorded. The most common weeds in this community are *Acetosella vulgaris* (0.81), *Hypochaeris radicata* (0.75) and *Taraxacum officinale* (0.38).

Threats: The threats facing this community are not unlike those experienced by other communities in the higher parts of Kosciuszko NP. The development of ski resorts and associated infrastructure, including ski runs resulted in significant clearing of the over-storey in some areas. Depending on the future expansion of ski fields, clearing may represent a future threat. Where the community occurs in close proximity to roads or tracks, invasion by exotic plant species including Ox-eye

Daisy (*Leucanthemum vulgare*), Sweet Vernal Grass (*Anthoxanthum odoratum*) and Orange Hawkweed (*Hieracium aurantiacum* subsp. *carpathicola*) is occurring. Grazing by feral herbivores, in particular horses, not only facilitates weed invasion via soil disturbance, but also affects groundlayer structure and species composition. Perhaps the most dramatic of all threats faced by this community is that of high fire frequency and intensity.

Reservation status: Almost entirely within conservation reserves, including Kosciuszko NP and Namadgi NP.

Extent of clearing: Historically, this community was extensively cleared to increase the area of optimal grazing land in leases. The extent of clearing is unknown but judging from historic aerial photography would have been many thousands of hectares. In most places, trees have re-invaded since the removal of grazing from Kosciuszko NP in the 1950s and 60s. In a few places, however, repeated tree removal and burning have changed this community into a disclimax shrubland.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u207: Jounama Snow Gum – Snow Gum shrubby mid-high woodland on granitoids primarily of the Namadgi region

Scientific Name: *Eucalyptus pauciflora* subsp. *debeuzevillei* – *Eucalyptus pauciflora* subsp. *pauciflora* / *Podolobium alpestre* – *Veronica perfoliata* – *Tasmannia xerophila* / *Poa sieberiana* – *Viola betonicifolia* – *Stellaria pungens* – *Coronidium scorpioides*

Number of samples:	24
Richness [mean (±SD)]:	24 (6)
Slope (degrees):	(3) 12–22 (32)
Altitude (m asl):	(1543) 1581–1680 (1745)
Ave. Annual Rainfall (mm):	(1186) 1271–1402 (1735)
Temp. Annual Range (°C):	(21.7) 22.2–22.7 (23)

Vegetation Description: Community u207 is a mid-high shrubby woodland dominated by *Eucalyptus pauciflora* subsp. *debeuzevillei* and *Eucalyptus pauciflora* subsp. *pauciflora*. The shrubby understorey is generally diverse, often including *Veronica perfoliata*, *Tasmannia xerophila*, *Podolobium alpestre*, *Daviesia ulicifolia*, *Oxylobium ellipticum*, *Olearia phlogopappa* and *Polyscias sambucifolia* subsp. *leptophylla*. *Acrothamnus hookeri* may be present. The groundlayer is a diverse mix of grasses and herbs, many of which occur in other high altitude communities. Typical species include *Poa sieberiana*, *Stellaria pungens*, *Viola betonicifolia*, *Coronidium scorpioides*, *Senecio gunnii*, *Asperula scoparia*, *Geranium potentilloides*, *Poranthera microphylla*, *Brachyscome spathulata*, *Acaena novae-zelandiae*, *Celmisia tomentella*, *Oreomyrris eriopoda*, *Dianella tasmanica*, *Wahlenbergia gloriosa* and *Arthropodium milleflorum*.

This community is almost entirely confined to the Upper Cotter and Yaouk Creek catchments of Namadgi NP and adjacent NSW parts of Kosciuszko NP, Bimberi NR and Scabby Range NR in the Australian Alps bioregion. It occurs in exposed locations at high altitude, primarily but not exclusively on northerly aspects. Although it is most common on granite, it is also known from metasedimentary geologies. A number of widespread montane communities occur in association with this community, including Community u22 [*Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands bioregions*], Community u23 [*Snow Gum – Epacris breviflora – Leptospermum myrtifolium tall woodland to open forest of drainage depressions primarily of the South Eastern Highlands bioregion*], Community u28 [*Snow Gum – Mountain Gum – Daviesia mimosoides tall dry grass-shrub subalpine open forest of the Australian Alps and South Eastern Highlands bioregions*] and



Plate u207: *Eucalyptus pauciflora* subsp. *debeuzevillei* with open *Poa sieberiana* patches characteristic of community u207. South-east of Snowy Flats off Mt. Franklin Road, Namadgi NP.

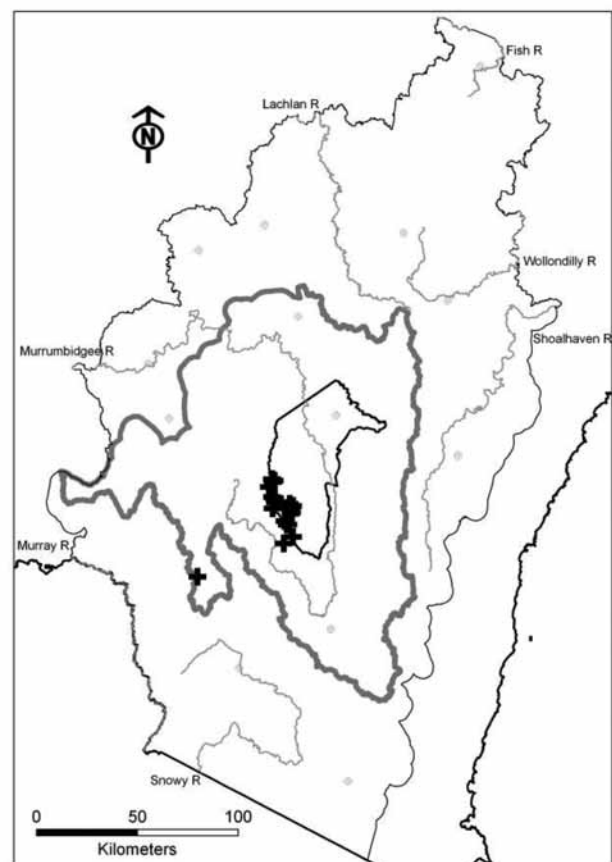


Fig. u207: Distribution of field samples assigned to this community.

Community u53 [Mountain Gum – Blackwood tall wet sclerophyll open forest primarily on granitoids of the Australian Alps and western South Eastern Highlands bioregions].

Class: Southern Tableland Grassy Woodlands

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia obliquinervia</i>	2	21	1	3			P
<i>Acrothamnus hookeri</i>	2	46	1	8			P
<i>Asperula scoparia</i>	2	58	2	22			P
<i>Brachyscome aculeata</i>	1	33	1	2			P
<i>Brachyscome spathulata</i>	2	38	1	11			P
<i>Celmisia tomentella</i>	2	33	1	<1			P
<i>Coronidium scorpioides</i>	2	75	1	19			P
<i>Craspedia</i> spp.	2	33	1	4			P
<i>Daviesia ulicifolia</i>	2	46	1	10			P
<i>Eucalyptus pauciflora</i> subsp. <i>debeuzevillei</i>	4	54	1	<1			P
<i>Geranium potentilloides</i>	2	50	1	13			P
<i>Leucopogon gelidus</i>	1	29	1	2			P
<i>Olearia megalophylla</i>	2	42	1	5			P
<i>Olearia phlogopappa</i>	1	42	1	3			P
<i>Oxylobium ellipticum</i>	3	46	1	4			P
<i>Ozothamnus thyrsoideus</i>	2	29	1	2			P
<i>Picris angustifolia</i> subsp. <i>angustifolia</i>	1	21	1	2			P
<i>Podolepis robusta</i>	2	21	1	<1			P
<i>Podolobium alpestre</i>	2	54	2	2			P
<i>Polyscias sambucifolia</i> subsp. <i>leptophylla</i>	3	38	2	4			P
<i>Senecio gunnii</i>	1	75	1	9			P
<i>Stellaria pungens</i>	2	88	2	31			P
<i>Tasmania xerophila</i>	2	50	1	1			P
<i>Veronica derwentiana</i>	2	33	1	7			P
<i>Veronica perfoliata</i>	2	54	1	4			P
<i>Viola betonicifolia</i>	2	92	1	27			P
<i>Wahlenbergia gloriosa</i>	1	29	1	2			P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	4	42	3	21			C
<i>Poa sieberiana</i>	3	71	2	48			C
<i>Poranthera microphylla</i>	2	46	1	27			C

Threatened communities: Nil.

Equivalent vegetation types: This community is similar to VG127 [Sub-Alpine Dry Shrub/Herb/Grass Woodland] previously described by Gellie (2005).

Frequently occurring weeds: Weeds are not common in this community, with only *Hypochaeris radicata* (0.33), a widespread species with high colonising potential, occurring in a large number of plots.

Threats: Grazing by feral herbivores and frequent and intense fire are the major threats faced by this community.

Reservation status: Likely to be confined to conservation reserves including Bimberi NR, Kosciuszko NP, Namadgi NP, Scabby Range NR and Yaouk NR.

Extent of clearing: Unlikely to have been significant because of the remoteness of this community and the landscape position upon which it is generally found.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

p24: Yellow Box – Blakely's Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus melliodora* ± *Eucalyptus blakelyi* – *Eucalyptus mannifera* – *Eucalyptus dives* / *Acacia decurrens* / *Lissanthe strigosa* – *Pimelea curviflora* / *Lomandra filiformis* subsp. *coriacea* – *Microlaena stipoides* – *Poa sieberiana* – *Gonocarpus tetragynus*

Number of samples:	28
Richness [mean (±SD)]:	29 (9)
Slope (degrees):	(0) 2–4 (9)
Altitude (m asl):	(615) 647–705 (815)
Ave. Annual Rainfall (mm):	(654) 670–697 (734)
Temp. Annual Range (°C):	(25.7) 26.1–26.6 (26.7)

Vegetation Description: Community p24 is a tall grassy open eucalypt woodland, with a medium to low tree canopy commonly containing *Eucalyptus blakelyi* and/or *Eucalyptus melliodora*, with other tableland eucalypts occurring less frequently including *Eucalyptus dives*, *Eucalyptus mannifera*, *Eucalyptus macrorhyncha* and *Eucalyptus rubida*. A sparse to patchy shrub stratum may be present, commonly with tall *Acacia decurrens* and smaller dry shrubs including *Acacia genistifolia* and *Daviesia latifolia*. The groundlayer in this community is generally dominated by a diverse suite of grasses including *Microlaena stipoides*, *Poa sieberiana*, *Themeda australis* and various *Aristida*, *Rytidosperma*, *Austrostipa* and *Dichelachne* species. A rich mix of forbs includes *Lomandra filiformis* subsp. *coriacea*, *Chrysocephalum apiculatum*, *Lomandra multiflora*, *Einadia nutans*, *Hydrocotyle laxiflora*, *Gonocarpus tetragynus*, *Goodenia hederacea* subsp. *hederacea*, *Plantago debilis* and *Dianella revoluta*. A sparse scatter of low tough shrubs (commonly *Lissanthe strigosa*, *Melichrus urceolatus*, *Pimelea curviflora* and *Bossiaea buxifolia* is often present.

This community is defined from field survey plots scattered across the relatively low, dry saddle of the great divide around Goulburn. Plots assigned to this community are located in an area bounded by Woodhouselee, Gundaroo, Manar, Koorngaroo and Canyonleigh (and extending east of the study area), and occur on gently undulating tableland country on relatively deep soils of moderately low fertility derived from volcanic rocks (porphyry, rhyolites and tuffs) and from ancient sediments/metasediments (greywacke, limestone, shale, siltstone, quartzite including Gundry and Towrang beds and various Adaminaby group strata).

Community p24 commonly grades into Community p23 [*Red Stringybark – Broad-leaved Peppermint tall dry sclerophyll grassy open forest on loamy rises primarily in the Bungonia subregion of the South Eastern Highlands bioregion*] on footslopes of hilly country with shallower soils, or into Community u78 [*Snow Gum grassy mid-high woodland of the South Eastern Highlands bioregion*] in cooler situations and/or with increasing elevation. In similar rolling country to the west with decreasing rainfall, this community is replaced by Community u19 [*Blakely's Red Gum – Yellow Box ± White Box tall grassy woodland of the Upper South Western Slopes and western South Eastern Highlands bioregions*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia decurrens</i>	2	46	1	1			P
<i>Acacia genistifolia</i>	2	39	1	1			P
<i>Aristida ramosa</i>	2	29	2	5			P
<i>Aristida vagans</i>	2	21	2	1			P
<i>Asperula conferta</i>	2	39	1	11			P
<i>Austrostipa scabra</i>	2	25	2	<1			P
<i>Bossiaea buxifolia</i>	2	29	1	7			P
<i>Cassinia arcuata</i>	2	25	1	1			P
<i>Cassinia laevis</i>	1	21	2	1			P
<i>Cheilanthes sieberi</i>	2	29	1	9			P
<i>Chrysocephalum apiculatum</i>	2	61	1	6			P
<i>Chrysocephalum semipapposum</i>	1	21	1	4			P
<i>Dichelachne micrantha</i>	1	29	1	10			P
<i>Einadia nutans</i>	2	50	1	4			P
<i>Eucalyptus blakelyi</i>	3	36	3	2			P
<i>Eucalyptus melliodora</i>	3	54	3	5			P
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	2	50	2	16			P
<i>Hydrocotyle laxiflora</i>	2	61	2	29			P
<i>Juncus usitatus</i>	1	21	1	<1			P
<i>Lissanthe strigosa</i>	2	64	1	6			P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	93	2	18			P
<i>Lomandra multiflora</i>	1	54	1	18			P
<i>Melichrus urceolatus</i>	1	39	1	13			P
<i>Microlaena stipoides</i>	2	82	2	34			P
<i>Opercularia aspera</i>	2	36	1	3			P
<i>Pimelea curviflora</i>	1	54	1	6			P
<i>Plantago debilis</i>	2	46	2	4			P
<i>Poa sieberiana</i>	2	79	2	48			P
<i>Pterostylis</i> spp.	2	21	1	6			P
<i>Rytidosperma laeve</i>	3	32	2	4			P
<i>Rytidosperma racemosum</i>	2	21	2	<1			P
<i>Themeda australis</i>	2	64	2	21			P
<i>Tricoryne elatior</i>	1	36	1	4			P
<i>Wahlenbergia luteola</i>	1	29	1	1			P
<i>Dianella revoluta</i>	2	43	1	22			C
<i>Gonocarpus tetragynus</i>	2	68	2	48			C



Plate p24: Grazed and partially cleared example of Community p24 on a crown reserve east of Tarlo River NP (plot CAN038LQ).

Threatened communities: This community is part of TSC Act 1995 – *White Box Yellow Box Blakely’s Red Gum Woodland* and EPBC Act 1999 – *White Box Yellow Box Blakely’s Red Gum Grassy Woodland and Derived Native Grassland*.

Equivalent vegetation types: Represents GWp24 [*Tableland Grassy Box – Gum Woodland*] (Tozer *et al.* 2010) in the context of the upper Murrumbidgee catchment, and includes a westward extension with the addition of new plots near Gundaroo. The current study area included some 63 of the 80 plots assigned to GWp24 by Tozer *et al.* (2010). There are no related Forest Ecosystems, with this community defined almost entirely by plots which were not classified by Gellie (2005).

Frequently occurring weeds: Weeds recorded in this community are typical of those found in other over-grazed grassy woodlands of the South Eastern Highlands bioregion. The most frequently recorded species are *Arctotheca calendula* (0.25), *Briza maxima* (0.21), *Bromus catharticus* (0.21), *Dactylis glomerata* (0.25), *Hypochaeris radicata* (0.63), *Paspalum dilatatum* (0.29), *Plantago lanceolata* (0.33) and *Rosa rubiginosa* (0.33).

Threats: This community occurs on undulating tableland country that was historically developed for stock grazing by the clearing of trees and shrubs and widespread conversion of groundlayer to pastures dominated by exotic annual grasses and legumes. Remnants are often regularly grazed and subject to ongoing invasion by exotic plants and feral animals. The condition of remnants adjacent to or within urban centres is generally declining because of recreational disturbances, firewood removal, over-grazing by domestic, feral and native herbivores and severe weed invasion. Urban and rural-residential development is also responsible for recent and predicted future clearing of remnant vegetation.

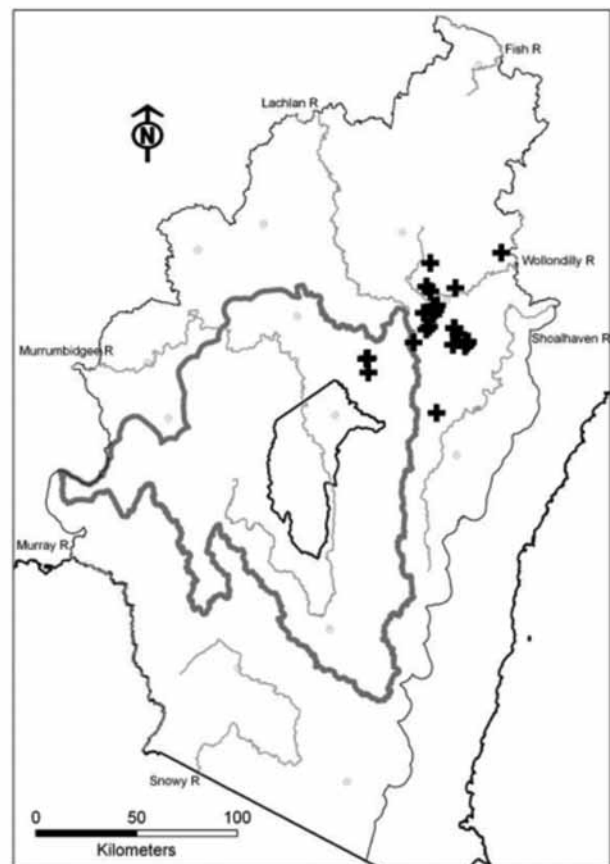


Fig. p24: Distribution of field samples assigned to this community

Reservation status: Due to the agriculturally desirable habitat of this community, it is very poorly represented in conservation reserves. The only samples from a conservation reserve are at the margins of cleared country in McLeod's Creek NR near Gundaroo.

Extent of clearing: The broad geographic distribution of small remnants and isolated paddock trees suggest that historically, this community was extensively cleared.

References: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

u19: Blakely's Red Gum – Yellow Box ± White Box tall grassy woodland of the Upper South Western Slopes and western South Eastern Highlands bioregions

Scientific Name: *Eucalyptus blakelyi* – *Eucalyptus melliodora* ± *Eucalyptus albens* / *Microlaena stipoides* – *Rytidosperma racemosum* – *Elymus scaber* – *Themeda australis* – *Austrostipa scabra*

Number of samples:	28
Richness [mean (±SD)]:	26 (10)
Slope (degrees):	(0) 2–5 (29)
Altitude (m asl):	(267) 469–593 (811)
Ave. Annual Rainfall (mm):	(646) 681–829 (1023)
Temp. Annual Range (°C):	(25.6) 26.7–28.1 (29)

Vegetation Description: Community u19 is a tall grassy eucalypt woodland dominated by *Eucalyptus blakelyi* and/or *Eucalyptus melliodora* with occasional occurrences of *Eucalyptus albens*. In the western part of its range, *Eucalyptus albens* can be the dominant eucalypt. The shrub layer is sparse or absent and generally contains regenerating eucalypts, *Acacia implexa* and/or *Acacia dealbata*. The groundlayer is dominated by grasses including *Microlaena stipoides*, *Elymus scaber*, *Themeda australis*, *Rytidosperma racemosum*, *Bothriochloa macra* and *Poa sieberiana*, with degraded areas generally dominated by less palatable robust species such as *Bothriochloa macra* and *Austrostipa scabra*. Forbs include *Hydrocotyle laxiflora*, *Rumex brownii*, *Geranium solanderi*, *Oxalis perennans*, *Lomandra filiformis* subsp. *coriacea* and *Tricoryne elatior*. Relatively undisturbed sites tend to have a wide variety of forbs including *Microris unifolia*, *Arthropodium minus*, *Dichopogon fimbriatus* and *Wurmbea dioica*.

This community occurs on flat and undulating fertile soils from north of Crookwell in the east to west of Tumut in the Upper Slopes subregion of the NSW South Western Slopes bioregion. Plot analysis post this study suggests that community u19 is also present in the northern ACT. To the east, it may grade into Community p24 [*Yellow Box – Blakely's Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands bioregion*] and Community u178 [*Yellow Box ± Apple Box tall grassy woodland of the South Eastern Highlands*] to the south-east in the ACT. West of the study area, this community grades into a number of Box-Gum woodland associations including the closely related VCA 277 [*Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South-western Slopes bioregion*] and, primarily in the South Western Slopes bioregion, the *Eucalyptus albens* dominated VCA 266 [*White Box grassy woodland in the Upper Slopes subregion of the NSW South-western Slopes bioregion*] described by Benson et al. (2010).



Plate u19: Community u19 with *Eucalyptus melliodora* and a grassy understorey of *Themeda australis* and *Rytidosperma racemosum*. Goorooyaroo NR.

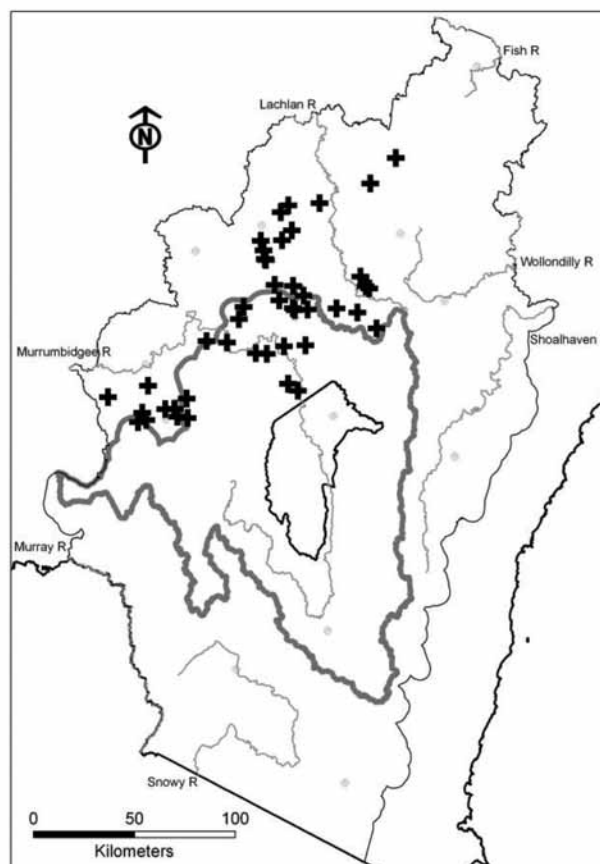


Fig. u19: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O	Fid
<i>Acaena echinata</i>	1	29	1	9		P
<i>Aristida ramosa</i>	2	46	2	5		P
<i>Arthropodium minus</i>	1	29	1	1		P
<i>Austrostipa scabra</i>	2	46	1	4		P
<i>Bothriochloa macra</i>	2	57	1	3		P
<i>Carex inversa</i>	1	36	1	8		P
<i>Convolvulus angustissimus</i>	1	25	1	3		P
<i>Crassula sieberiana</i>	1	21	1	5		P
<i>Dichopogon fimbriatus</i>	1	29	1	<1		P
<i>Drosera peltata</i>	1	21	1	1		P
<i>Elymus scaber</i>	2	75	1	21		P
<i>Eucalyptus albens</i>	4	32	3	<1		P
<i>Eucalyptus blakelyi</i>	3	61	2	2		P
<i>Eucalyptus melliodora</i>	3	57	3	5		P
<i>Geranium solanderi</i>	1	61	1	19		P
<i>Hydrocotyle laxiflora</i>	1	68	2	29		P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	1	50	2	19		P
<i>Microlaena stipoides</i>	3	86	2	34		P
<i>Microtis unifolia</i>	1	32	1	4		P
<i>Oxalis perennans</i>	1	57	1	13		P
<i>Panicum effusum</i>	1	29	1	3		P
<i>Rumex brownii</i>	1	68	1	9		P
<i>Rytidosperma erianthum</i>	2	32	1	<1		P
<i>Rytidosperma pilosum</i>	2	29	2	9		P
<i>Rytidosperma racemosum</i>	2	50	2	10		P
<i>Schoenus apogon</i>	1	32	1	5		P
<i>Solenogyne dominii</i>	1	39	1	3		P
<i>Themeda australis</i>	3	54	2	21		P
<i>Tricoryne elatior</i>	1	50	1	3		P
<i>Wurmbea dioica</i>	1	25	1	3		P
<i>Gonocarpus tetragynus</i>	1	43	2	48		C
<i>Poa sieberiana</i>	1	57	2	48		C

Threatened communities: This community is part of the TSC Act 1995 – *White Box Yellow Box Blakely's Red Gum Woodland*; EPBC Act 1999 – *White Box Yellow Box Blakely's Red Gum Grassy Woodland* and *Derived Native Grassland*; and NC Act 1980 – *Yellow Box/Red Gum Grassy Woodland*.

Equivalent vegetation types: This community is most similar to VCA 277 [*Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South-western Slopes bioregion*] (Benson et al. 2010) and is similar to a number of communities described by Gellie (2005) including VG116, VG117, VG154 and VG160. At the western edge of its range, there may be areas dominated by *Eucalyptus albens*, and in this instance it will be most akin to VCA 266 [*White Box grassy woodland in the Upper Slopes subregion of the NSW South-western Slopes bioregion*] (Benson et al. 2010).

Frequently occurring weeds: Most remnants of this community are found on freehold land and actively managed as a source of food and shelter for domestic stock. As a consequence of this, many remnants are now infested with common pasture weeds including *Briza maxima* (0.63), *Briza minor* (0.67), *Bromus diandrus* (0.56), *Bromus molliformis* (0.59), *Cirsium vulgare* (0.48), *Cynosurus echinatus* (0.37), *Echium plantagineum* (0.33), *Hypericum perforatum* (0.7), *Hypochaeris glabra* (0.52), *Hypochaeris radicata* (0.7), *Lolium perenne* (0.44), *Lysimachia arvensis* (0.33), *Orobancha minor* (0.41), *Petrorhagia nanteuilii* (0.59), *Plantago lanceolata* (0.48), *Romulea rosea* var. *australis* (0.33), *Rosa rubiginosa* (0.33), *Sherardia arvensis* (0.44), *Trifolium angustifolium* (0.63), *Trifolium arvense* (0.52), *Trifolium campestre* (0.56), *Trifolium dubium* (0.48), *Trifolium striatum* (0.41), *Trifolium subterraneum* (0.52) and *Vulpia muralis* (0.37).

Threats: Because this community naturally occurs on soils of high fertility, it has experienced high levels of clearing. Remnants are often subjected to ongoing grazing by domestic stock, the addition of fertiliser and exotic pasture species, firewood removal and invasion by weed and pest species. The extent of disturbance has severely compromised the condition of most remnants of this community across its range. As a

result, there are very few examples with an intact over-storey, high native plant species richness, low exotic weed species richness and abundance, over-storey regeneration and high structural integrity.

Reservation status: Poorly conserved. Examples are found in Burrinjuck NR, as well as Dunlop NR and Goorooyaroo NR in the ACT.

Extent of clearing: Known to be highly cleared. Due to continued and intense grazing, large areas containing healthy, regenerating overstorey species are rare.

References: Benson, J.S., Richards, P.G., Waller, S. & Allen, C.B. (2010) New South Wales vegetation classification and assessment: Part 3. Plant communities of the NSW Brigalow Belt South, Nandewar and west New England bioregions and update of NSW Western Plains and South Western Slopes plant communities. Version 3 of the NSW VCA database. *Cunninghamia* 11: 457–579. Botanic Gardens Trust, Sydney; Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

u20: *Brachychiton populneus* – *Bursaria spinosa* – *Themeda australis* shrub-grass mid-high open woodland on limestone karsts in the Wee Jasper area

Scientific Name: *Brachychiton populneus* – *Eucalyptus bridgesiana* / *Grevillea iaspicula* – *Bursaria spinosa* / *Themeda australis* – *Poa sieberiana* – *Imperata cylindrica*

Number of samples:	3
Richness [mean (±SD)]:	35 (6)
Slope (degrees):	(1) 3–8 (12)
Altitude (m asl):	(375) 377–407 (436)
Ave. Annual Rainfall (mm):	(850) 851–875 (897)
Temp. Annual Range (°C):	(26.2) 26.4–26.5 (26.5)

Vegetation Description: Community u20 is a mid-high open woodland with sparsely scattered trees of *Brachychiton populneus* and *Eucalyptus bridgesiana* with occasional *Eucalyptus albens* and *Eucalyptus melliodora*. It has a moderately dense tall shrub layer commonly dominated by *Bursaria spinosa*. Other co-occurring shrub species include *Grevillea iaspicula* (Critically Endangered under the TSC Act 1995), *Dodonaea viscosa*, *Rubus parviflora*, *Indigophora signata*, *Discaria pubescens* and *Olearia* spp.. There is often a dense grassy groundlayer dominated by *Themeda australis* and *Poa sieberiana*. Other groundlayer species include *Imperata cylindrica*, *Microlaena stipoides*, *Bulbine glauca*, *Cymbopogon refractus*, *Sorghum leiocladum* and *Rytidosperma* spp. While many of the taxa recorded in this community are regionally uncommon, the presence of *Imperata cylindrica* is notable in that it is generally known primarily from the coast and the Nandewar bioregion.

This community is highly restricted in distribution, being endemic to limestone karst formations from just south of Wee Jasper to Lake Burrinjuck. The soil is a skeletal to shallow red-brown loam. Driven by geology rather than landform, it occurs on all aspects and the terrain varies from flat to gently sloping to very steep. At some sites within the karst there are large sinkholes or low cliffs where components of the vegetation grow on almost vertical limestone formations.

Characteristic Species:

Species	C/A	Freq	C/A	O Freq	O	Fid
<i>Arthropodium milleflorum</i>	1	100	1	8		P
<i>Arthropodium minus</i>	1	33	1	1		P
<i>Asperula ambleia</i>	1	33	1	<1		P
<i>Bothriochloa macra</i>	1	100	1	3		P
<i>Brachychiton populneus</i>	2	100	1	2		P
<i>Bulbine glauca</i>	1	100	1	<1		P
<i>Bursaria spinosa</i>	2	100	1	10		P
<i>Carex incommitata</i>	1	33	1	1		P



Plate u20: Community u20 with *Grevillea iaspicula* on limestone outcrops in foreground, on private property 2 km south of Wee Jasper.

<i>Clematis microphylla</i>	2	67	1	<1	P
<i>Convolvulus angustissimus</i>	1	67	1	3	P
<i>Correa reflexa</i>	1	33	1	<1	P
<i>Daucus glochidiatus</i>	1	100	1	8	P
<i>Dianella longifolia</i>	1	67	1	3	P
<i>Discaria pubescens</i>	1	33	1	<1	P
<i>Dodonaea viscosa</i>	1	67	1	2	P
<i>Echinopogon cheelii</i>	1	33	1	1	P
<i>Elymus scaber</i>	1	100	1	21	P
<i>Eucalyptus bridgesiana</i>	2	67	3	7	P
<i>Geranium solanderi</i>	1	100	1	19	P
<i>Glycine clandestina</i>	1	100	1	30	P
<i>Glycine tabacina</i>	1	67	1	4	P
<i>Grevillea iaspicula</i>	1	100	0	0	P
<i>Hydrocotyle laxiflora</i>	1	100	2	30	P
<i>Imperata cylindrica</i>	1	100	2	<1	P
<i>Indigofera adesmiifolia</i>	1	67	1	<1	P
<i>Microtis</i> spp.	1	33	1	<1	P
<i>Olearia</i> spp.	1	33	1	<1	P
<i>Pleurosorus rutifolius</i>	1	67	1	<1	P
<i>Poa sieberiana</i>	1	100	2	48	P
<i>Senecio quadridentatus</i>	1	67	1	6	P
<i>Themeda australis</i>	4	100	2	21	P
<i>Wahlenbergia</i> spp.	1	67	1	5	P
<i>Desmodium varians</i>	1	67	1	12	C
<i>Dichondra repens</i>	1	67	2	21	C
<i>Rubus parvifolius</i>	2	67	1	11	C
<i>Rytidosperma racemosum</i>	1	67	2	10	C

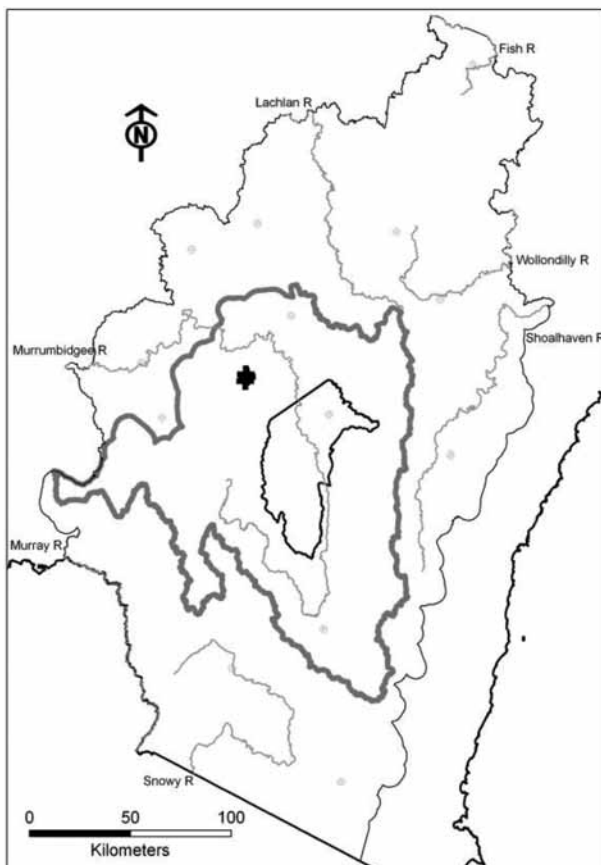


Fig. u20: Distribution of field samples assigned to this community.

Threatened communities: Not currently listed, but possibly eligible for listing as Critically Endangered due to its highly restricted distribution and current / historic threats. Areas with *Eucalyptus albens* or *Eucalyptus melliodora* and a grassy understorey are considered part of TSC Act 1995 – *White Box Yellow Box Blakely’s Red Gum Woodland* and EPBC Act 1999 – *White Box Yellow Box Blakely’s Red Gum Grassy Woodland and Derived Native Grassland*.

Equivalent vegetation types: Nil. Poorly sampled community.

Frequently occurring weeds: This community appears to be highly susceptible to weed invasion. Weeds were abundant at most sites, demonstrating the extent of past grazing disturbance, and also the sensitivity of the community to that disturbance. The most common weeds recorded were *Briza minor* (0.33), *Bromus diandrus* (0.33), *Bromus molliformis* (0.33), *Bromus tectorum* (0.67), *Carthamus lanatus* (1.00), *Centaurium erythraea* (1.00), *Cerastium glomeratum* (0.33), *Chondrilla juncea* (0.67), *Cirsium vulgare* (0.33), *Cotoneaster glaucophyllus* (0.33), *Cynosurus echinatus* (0.33), *Hypericum perforatum* (1.00), *Hypochaeris radicata* (0.67), *Lactuca serriola* (1.00), *Lysimachia arvensis* (0.67), *Petrorhagia nanteuilii* (0.33), *Pyracantha angustifolia* (0.33), *Rosa rubiginosa* (1.00), *Rubus fruticosus* sp. agg. (1.00), *Torilis nodosa* (0.67), *Trifolium angustifolium* (0.33), *Trifolium arvense* (0.33), *Trifolium campestre* (0.33) and *Vulpia myuros* f. *megalura* (0.33), all of which are widespread throughout the region.

Threats: Highly threatened and few relatively intact examples remain. Previous clearing and heavy grazing by domestic stock have almost completely destroyed the tree and shrub layer from all but the most rocky sites where stock have had difficulty gaining access. Some of the sites which have escaped intensive stock grazing are now heavily invaded by *Rubus fruticosus* sp. agg. and *Rosa rubiginosa* and other exotic shrubs such as *Cotoneaster* spp. and *Photinia serratifolia*. Many sites also have significant infestations of *Hypericum perforatum* on their margins where there has been greater disturbance due to grazing.

Reservation status: Extremely poorly represented within conservation reserves. A small area of one to two hectares occurs in Burrinjuck NR on the southern shores of Lake Burrinjuck. Unfortunately the shrub and groundlayer in this part of the reserve have been significantly degraded due to feral goat browsing.

Extent of clearing: It is estimated that over 90% of karst habitat has been cleared in the region, with only approximately 10 hectares remaining in reasonably intact condition.

u178: Yellow Box – Apple Box tall grassy woodland of the South Eastern Highlands

Scientific Name: *Eucalyptus melliodora* – *Eucalyptus bridgesiana* / *Austrostipa scabra* – *Themeda australis* – *Panicum effusum* – *Chrysocephalum apiculatum* – *Oxalis perennans*

Number of samples:	33
Richness [mean (±SD)]:	46 (11)
Slope (degrees):	(1) 3–9 (18)
Altitude (m asl):	(613) 662–759 (862)
Ave. Annual Rainfall (mm):	(571) 638–664 (699)
Temp. Annual Range (°C):	(26.2) 26.5–27 (27.5)

Vegetation Description: Community u178 is a tall grassy eucalypt woodland characterised by *Eucalyptus melliodora* and/or *Eucalyptus bridgesiana*, occasionally with *Eucalyptus blakelyi* along creeklines and in moist depressions. In the southern extent of its range scattered occurrences of *Eucalyptus rubida* are increasingly common. Whilst often containing a mix of these species, some examples may be dominated entirely by *Eucalyptus melliodora* or *Eucalyptus bridgesiana*. The shrub layer is sparse or absent and may include *Acacia dealbata*, with low shrubs such as *Melichrus urceolatus*, *Astroloma humifusum* and *Cryptandra amara* occurring on less fertile sites. The groundlayer is dense and dominated by herbaceous taxa, with grasses including *Themeda australis*, *Austrostipa scabra*, *Poa sieberiana*, *Panicum effusum* and *Elymus scaber*. Forbs include *Oxalis perennans*, *Hydrocotyle laxiflora*, *Acaena ovina*, *Desmodium varians*, *Chrysocephalum apiculatum*, *Cymbonotus lawsonianus*, *Geranium solanderi* and *Glycine tabacina*.

This community occurs from the Lake George area south to Michelago / Bredbo. It is generally found on fertile valley soils, although it may extend upslope. It is likely to have been widely distributed throughout the northern half of the ACT prior to urban expansion. In the ACT and surrounds, it often occurs downslope of less fertile communities such as Community u66 [*Mealy Bundy – Red Stringybark grass-herb mid-high open forest of the South Eastern Highlands and Upper Slopes subregion of the South Western Slopes bioregion*] and Community p14 [*Red Stringybark – Scribbly Gum – Rytidosperma pallidum tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion*]. Further south around Bredbo, it often occurs downslope of Community u29 [*Apple Box – Broad-leaved Peppermint tall shrub-grass woodland primarily on granitoids of the South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acaena ovina</i>	1	79	1	7			P
<i>Aristida ramosa</i>	1	33	2	5			P
<i>Arthropodium minus</i>	1	24	1	1			P
<i>Asperula conferta</i>	1	36	1	11			P
<i>Astroloma humifusum</i>	1	21	1	5			P
<i>Austrostipa bigeniculata</i>	1	27	2	<1			P
<i>Austrostipa scabra</i>	1	82	2	3			P
<i>Bothriochloa macra</i>	1	45	1	3			P
<i>Bulbine bulbosa</i>	1	24	1	4			P
<i>Carex inversa</i>	1	33	1	8			P
<i>Cheilanthes sieberi</i>	1	39	1	9			P
<i>Chrysocephalum apiculatum</i>	1	70	1	5			P
<i>Chrysocephalum semipapposum</i>	1	21	1	4			P
<i>Convolvulus angustissimus</i>	1	39	1	3			P
<i>Crassula sieberiana</i>	1	55	1	5			P
<i>Cymbonotus lawsonianus</i>	1	67	1	4			P
<i>Cynoglossum suaveolens</i>	1	30	1	3			P
<i>Daucus glochidiatus</i>	1	64	1	8			P
<i>Desmodium varians</i>	1	79	1	12			P
<i>Dichelachne micrantha</i>	1	33	1	10			P



Plate u178: An example of Community u178 dominated by *Eucalyptus melliodora* with a grassy understorey, Campbell Park, Canberra.

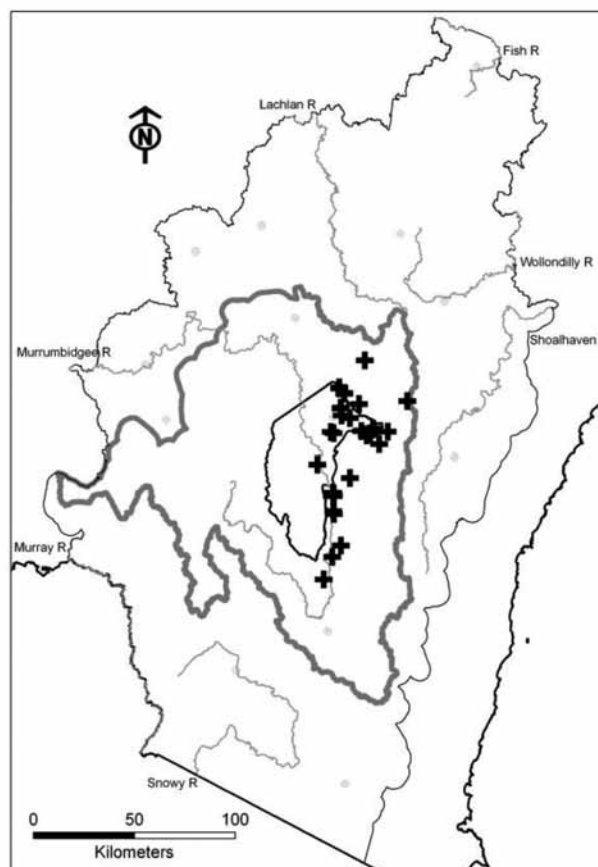


Fig. u178: Distribution of field samples assigned to this community.

<i>Einadia nutans</i>	1	48	1	4	P
<i>Elymus scaber</i>	1	61	1	21	P
<i>Enneapogon nigricans</i>	1	27	1	<1	P
<i>Eryngium ovinum</i>	1	21	1	<1	P
<i>Eucalyptus blakelyi</i>	2	21	3	2	P
<i>Eucalyptus bridgesiana</i>	3	52	3	7	P
<i>Eucalyptus melliodora</i>	3	58	3	5	P
<i>Euchiton involucratus</i>	1	33	1	3	P
<i>Euchiton sphaericus</i>	1	24	1	7	P
<i>Euchiton</i> spp.	1	24	1	<1	P
<i>Geranium solanderi</i>	1	67	1	19	P
<i>Glycine tabacina</i>	1	61	1	3	P
<i>Hydrocotyle laxiflora</i>	1	88	2	29	P
<i>Hypericum gramineum</i>	1	67	1	25	P
<i>Leptorhynchus squamatus</i>	1	33	1	3	P
<i>Lomandra filiformis</i>	1	48	1	2	P
<i>Lomandra multiflora</i>	1	42	1	18	P
<i>Melichrus urceolatus</i>	1	48	1	13	P
<i>Oxalis perennans</i>	1	85	1	13	P
<i>Panicum effusum</i>	1	67	1	3	P
<i>Pimelea curviflora</i>	1	39	1	6	P
<i>Plantago gaudichaudii</i>	1	27	1	1	P
<i>Plantago varia</i>	1	58	1	11	P
<i>Poa sieberiana</i>	1	76	2	48	P
<i>Rumex brownii</i>	1	67	1	9	P
<i>Rytidosperma</i> spp.	2	52	1	7	P
<i>Schoenus apogon</i>	1	33	1	5	P
<i>Sebaea ovata</i>	1	21	1	<1	P
<i>Senecio quadridentatus</i>	1	33	1	5	P
<i>Solenogyne dominii</i>	1	58	1	3	P
<i>Themeda australis</i>	2	79	2	20	P
<i>Tricoryne elatior</i>	1	36	1	4	P
<i>Triptilodiscus pygmaeus</i>	1	30	1	<1	P
<i>Vittadinia cuneata</i>	1	21	1	2	P
<i>Vittadinia muelleri</i>	1	58	1	1	P
<i>Wahlenbergia communis</i>	1	45	1	4	P
<i>Wahlenbergia</i> spp.	1	48	1	5	P
<i>Wurmbea dioica</i>	1	45	1	2	P
<i>Gonocarpus tetragynus</i>	1	64	2	48	C
<i>Microlaena stipoides</i>	1	55	2	34	C

Threatened communities: This community is part of the TSC Act 1995 – *White Box Yellow Box Blakely's Red Gum Woodland*; EPBC Act 1999 – *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland*; NC Act 1980 – *Yellow Box/Red Gum Grassy Woodland*.

Equivalent vegetation types: This community is mostly made up of new plots but includes some plots which were used to define VG160 [*Western Slopes Dry Grass Woodland*] (Gellie 2005).

Frequently occurring weeds: The most frequently recorded weeds are also those found in other over-grazed grassy woodlands of the South Eastern Highlands bioregion, including *Acetosella vulgaris* (0.31), *Centaurium erythraea* (0.53), *Hypochaeris radicata* (0.81), *Linaria arvensis* (0.31), *Petrorhagia nanteuilii* (0.88), *Plantago lanceolata* (0.38), *Rosa rubiginosa* (0.59), *Trifolium arvense* (0.81), *Trifolium campestre* (0.38) and *Vulpia myuros* f. *megalura* (0.44).

Threats: This vegetation type has been extensively cleared for various agricultural purposes, including cropping and grazing. In the ACT, urban development was, and continues to be the catalyst for further clearing of this community. Because of its distribution on the flat, fertile and well-watered parts of the landscape, most remaining remnants are subject to intensive domestic stock grazing and weed invasion. As a consequence the majority of remnants now contain a depauperate native groundlayer and shrub/midstorey.

Reservation status: Unknown, although small patches of this community are occur in the Mt. Majura, Mt. Ainslie and Mugga Mugga sections of Canberra Nature Park, and Stony Creek NR in NSW. Very small remnants may be present in Mulligans Flat NR and Goorooyarroo NR.

Extent of clearing: Not fully assessed, but given its occurrence on fertile soils and distribution across urban and peri-urban areas it is considered to be one of the most highly cleared and modified components of the Box-Gum alliance.

Reference: Gellie, N.J.H. (2005) Native vegetation of the southern forests: South Eastern Highlands, Australian Alps, South West Slopes and South East Corner bioregions. *Cunninghamia* 9: 219–254.

Class: Tableland Clay Grassy Woodlands

p220: Ribbon Gum – Snow Gum tableland flats tall grassy woodland primarily on granitoids in the Kybean – Gourock and Monaro subregions of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus viminalis* – *Eucalyptus pauciflora* subsp. *pauciflora* / *Microlaena stipoides* – *Themeda australis* – *Poa labillardierei* – *Glycine clandestina* – *Dichondra repens* – *Gonocarpus tetragynus*

Number of samples:	52
Richness [mean (±SD)]:	40 (9)
Slope (degrees):	(0) 2–10 (18)
Altitude (m asl):	(585) 729–950 (1125)
Ave. Annual Rainfall (mm):	(677) 820–901 (1006)
Temp. Annual Range (°C):	(23.5) 24.5–25.6 (26.2)

Vegetation Description: Community p220 is a tall grassy woodland dominated by *Eucalyptus pauciflora* subsp. *pauciflora* and *Eucalyptus viminalis*, occasionally with *Eucalyptus radiata* subsp. *radiata*. The shrub layer is sparse or absent, with occasional occurrences of *Acacia melanoxylon*, *Rubus parvifolius* and low shrubs such as *Hibbertia obtusifolia* and *Bossiaea buxifolia*. The groundlayer is dense and dominated by grasses such as *Microlaena stipoides*, *Themeda australis*, *Poa labillardierei*, *Elymus scaber* and *Poa meionectes*, with forbs including *Glycine clandestina*, *Dichondra repens*, *Gonocarpus tetragynus*, *Hypericum gramineum*, *Hydrocotyle laxiflora*, *Acaena novae-zelandiae* and *Desmodium varians*.

This community occurs primarily on granitic soils on flat to gently undulating terrain east of the Great Dividing Range from Braidwood south to Bombala area, and westward to Tinderry NR. Along drainage lines this community may grade into the floristically similar Community p520 [*Ribbon Gum very tall woodland on alluvial soils along drainage lines of the eastern South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia melanoxylon</i>	1	50	1	13			P
<i>Acaena novae-zelandiae</i>	2	63	1	27			P
<i>Acrotriche serrulata</i>	1	40	1	11			P
<i>Ajuga australis</i>	2	31	1	7			P
<i>Austrostipa rudis</i>	2	15	1	3			P
<i>Bossiaea buxifolia</i>	2	46	1	6			P
<i>Carex</i> spp.	2	13	1	2			P
<i>Cymbonotus lawsonianus</i>	1	17	1	5			P
<i>Cynoglossum australe</i>	1	15	1	4			P
<i>Desmodium gunnii</i>	2	27	2	1			P
<i>Desmodium varians</i>	2	42	1	12			P
<i>Dianella longifolia</i>	1	31	1	2			P
<i>Dichelachne inaequiglumis</i>	2	33	2	6			P
<i>Dichondra repens</i>	2	77	2	20			P
<i>Einadia nutans</i>	2	17	1	4			P

<i>Elymus scaber</i>	1	48	1	21	P
<i>Eucalyptus pauciflora</i> subsp <i>pauciflora</i>	3	79	3	20	P
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>	3	27	3	11	P
<i>Eucalyptus stellulata</i>	1	15	2	3	P
<i>Eucalyptus viminalis</i>	3	85	3	12	P
<i>Euchiton japonicus</i>	2	33	1	15	P
<i>Geranium solanderi</i>	2	40	1	19	P
<i>Glycine clandestina</i>	2	77	1	29	P
<i>Gonocarpus tetragynus</i>	2	73	2	47	P
<i>Hovea heterophylla</i>	1	23	1	4	P
<i>Hovea linearis</i>	2	33	1	13	P
<i>Hydrocotyle laxiflora</i>	2	60	2	29	P
<i>Hypericum gramineum</i>	1	67	1	25	P
<i>Lomandra longifolia</i>	2	63	2	42	P
<i>Lomandra multiflora</i>	1	44	1	18	P
<i>Microlaena stipoides</i>	2	88	2	33	P
<i>Oxalis</i> spp.	2	21	1	3	P
<i>Panicum effusum</i>	1	13	1	3	P
<i>Poa labillardierei</i>	3	62	2	9	P
<i>Poa meionectes</i>	2	52	2	16	P
<i>Pteridium esculentum</i>	2	52	2	27	P
<i>Pultenaea subspicata</i>	2	13	2	2	P
<i>Rubus parvifolius</i>	2	52	1	11	P
<i>Rytidosperma laeve</i>	2	19	2	4	P
<i>Rytidosperma pilosum</i>	2	29	2	9	P
<i>Scleranthus biflorus</i>	1	40	1	9	P
<i>Senecio prenanthoides</i>	2	52	1	19	P
<i>Solenogyne gunnii</i>	1	15	1	5	P
<i>Themeda australis</i>	2	79	2	20	P
<i>Veronica calycina</i>	2	44	1	16	P
<i>Veronica plebeia</i>	1	25	1	6	P
<i>Viola betonicifolia</i>	2	48	1	27	P
<i>Wahlenbergia</i> spp.	1	17	1	5	P
<i>Hibbertia obtusifolia</i>	2	50	1	34	C
<i>Poa sieberiana</i>	3	40	2	48	C

Threatened communities: This community is part of the TSC Act 1995 – *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions.*

Equivalent vegetation types: This community is largely equivalent to GWp220 [*Southern Tableland Flats Forest*] (Tozer et al. 2010).

Frequently occurring weeds: Remnants of this community are generally restricted to freehold grazing land. The most frequently encountered weeds are therefore those that are typical of other grassy woodlands in the South Eastern Highlands bioregion, including *Acetosella vulgaris* (0.37), *Cirsium vulgare* (0.27), *Holcus lanatus* (0.25), *Hypochaeris radicata* (0.92), and *Rosa rubiginosa* (0.27).

Threats: This formerly widespread community has historically been the target of extensive clearing for pastoral development. The community is now highly fragmented, generally only existing in small remnants or as secondary grassland. Remaining examples are subject to grazing pressures, weed invasion, firewood collection and occasional small-scale clearing. Canopy dieback is a significant problem across much of the range of this community.

Reservation status: Likely to be poorly reserved. Examples of this community are found in Badja Swamps NR, Coolumbooka NR, Deua NP, Monga SCA and Tinderry NR.

Extent of clearing: This community has been widely cleared across its range primarily for pastoral development.

Reference: Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.



Plate p220: Community p220 beside Araluen Road near Reidsdale, with *Eucalyptus viminalis* and *Acacia melanoxylon* over a grassy groundcover dominated by *Poa labillardierei* var. *labillardierei*.

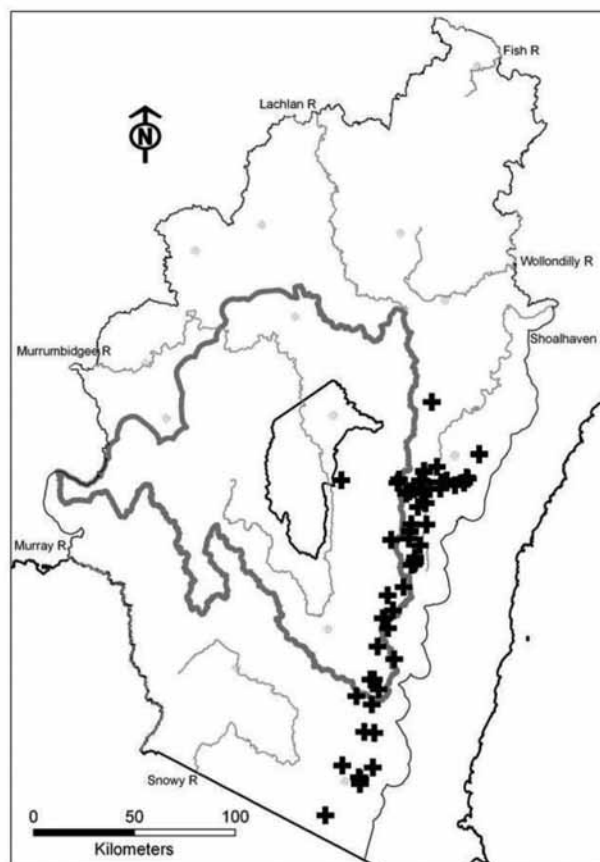


Fig. p220: Distribution of field samples assigned to this community.

p520: Ribbon Gum very tall woodland on alluvial soils along drainage lines of the eastern South Eastern Highlands bioregion

Scientific Name: *Eucalyptus viminalis* ± *Eucalyptus stellulata* – *Eucalyptus pauciflora* subsp. *pauciflora* / *Microlaena stipoides* – *Poa labillardierei* – *Dichondra repens* – *Acaena novae-zelandiae*

Number of samples: 42
 Richness [mean (±SD)]: 33 (11)
 Slope (degrees): (0) 3–8 (19)
 Altitude (m asl): (551) 641–860 (1140)
 Ave. Annual Rainfall (mm): (639) 702–856 (968)
 Temp. Annual Range (°C): (23.7) 24.8–26.1 (26.5)

Vegetation Description: Community p520 is a very tall woodland to open forest characterised by *Eucalyptus viminalis*, sometimes with *Eucalyptus stellulata*, *Eucalyptus pauciflora* subsp. *pauciflora* or *Eucalyptus rubida*. Occasionally, *Eucalyptus aggregata* may be present. The shrub layer is sparse or absent, with infrequent groves of *Acacia melanoxylon*, *Acacia mearnsii*, *Lomatia myricoides* or *Leptospermum myrtifolium*. The groundlayer is dense and dominated by grasses such as *Microlaena stipoides*, *Poa labillardierei* and *Echinopogon ovatus*, with forbs including *Acaena novae-zelandiae*, *Dichondra repens*, *Hydrocotyle laxiflora*, *Stellaria pungens* and *Geranium solanderi*.

This community is distributed on alluvial flats across eastern parts of the South Eastern Highlands bioregion, from the Abercrombie River in the north to east of the Bredbo – Cooma area. Although unsampled further west, it is likely to occur in sandy lenses and creek flats along the Murrumbidgee River corridor in the ACT. It generally occurs on creek flats and coarse sandy alluvial soils along drainage channels. Away from the riparian zone, it commonly grades into Community p220 [*Ribbon Gum* – *Snow Gum tableland flats tall grassy woodland primarily on granitoids in the Kybean – Gourock and Monaro subregions of the South Eastern Highlands bioregion*] or, in steeper country, numerous dry sclerophyll forest types.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acacia mearnsii</i>	3	19	2	3			P
<i>Acaena novae-zelandiae</i>	2	79	1	27			P
<i>Carex appressa</i>	1	45	1	6			P
<i>Carex inversa</i>	1	29	1	8			P
<i>Desmodium varians</i>	2	36	1	12			P
<i>Dichondra repens</i>	2	83	2	20			P
<i>Echinopogon ovatus</i>	2	45	1	10			P
<i>Einadia nutans</i>	1	24	1	4			P
<i>Eucalyptus rubida</i>	2	26	3	9			P
<i>Eucalyptus stellulata</i>	3	38	2	3			P
<i>Eucalyptus viminalis</i>	3	62	3	12			P
<i>Geranium solanderi</i>	2	52	1	19			P
<i>Glycine clandestina</i>	1	45	1	29			C
<i>Glycine tabacina</i>	2	21	1	3			P
<i>Hydrocotyle laxiflora</i>	2	62	2	29			P
<i>Lomandra longifolia</i>	2	45	2	42			C
<i>Microlaena stipoides</i>	3	95	2	33			P
<i>Oreomyrrhis eriopoda</i>	2	45	1	13			P
<i>Oxalis perennans</i>	2	36	1	13			P
<i>Poa labillardierei</i>	3	69	2	9			P
<i>Poranthera microphylla</i>	1	48	1	27			C
<i>Rubus parvifolius</i>	2	36	1	11			P
<i>Rumex brownii</i>	1	48	1	9			P
<i>Rytidosperma racemosum</i>	2	43	2	10			P
<i>Solenogyne gunnii</i>	1	19	1	5			P
<i>Stellaria pungens</i>	2	57	2	31			P
<i>Veronica plebeia</i>	1	26	1	6			P
<i>Viola betonicifolia</i>	1	48	1	27			C



Plate p520: Community p520, Doughboy TSR (near plot MAN021A), with *Eucalyptus viminalis* and *Eucalyptus stellulata* over scattered *Acacia mearnsii* and a diverse grass/forb groundcover.

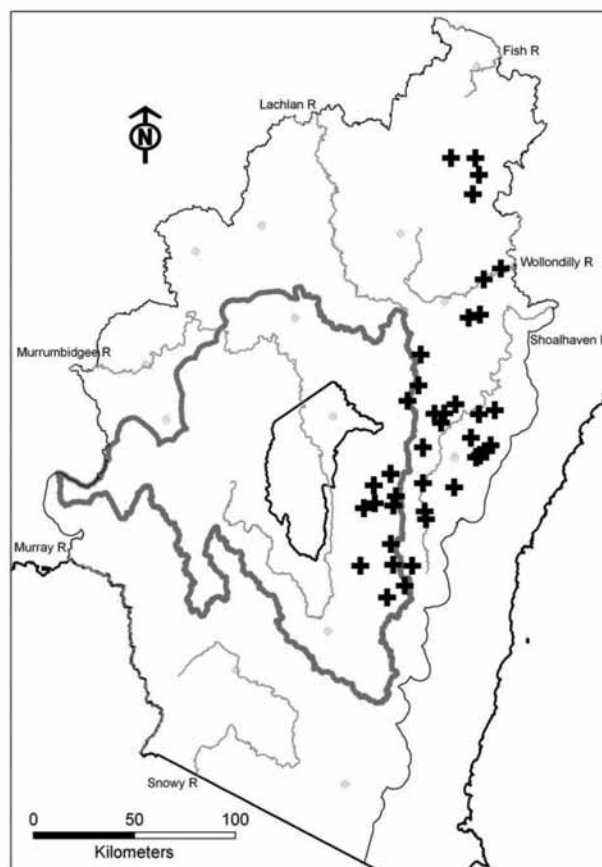


Fig. p520: Distribution of field samples assigned to this community.

Threatened communities: This community is part of the TSC Act 1995 – *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions.*

Equivalent vegetation types: This community is similar to GWp520 [Tableland Swamp Flats Forest] (Tozer et al. 2010), with the community described in this study containing a higher frequency of *Eucalyptus stellulata* and *Eucalyptus rubida*, and less *Eucalyptus pauciflora* ssp. *pauciflora*.

Frequently occurring weeds: Although examples of this community are found on public land, the majority of remnants occur on freehold grazing land. As with most grassy woodlands on this tenure, weeds are a major component of the remnant vegetation, the most common of which are *Acetosella vulgaris* (0.55), *Cirsium vulgare* (0.74), *Holcus lanatus* (0.5), *Hypochoeris radicata* (0.79), *Plantago lanceolata* (0.47), *Rosa rubiginosa* (0.42), *Rubus ulmifolius* (0.37) and *Trifolium repens* (0.32).

Threats: Community p520 was extensively cleared because it occupied relatively fertile alluvial soils suitable for agriculture. Examples on sandy alluvial lenses may be subject to less clearing pressure. Remnants are generally small and isolated, subject to ongoing degradation from domestic stock grazing, weed invasion, firewood collection and small-scale clearing.

Reservation status: Unknown, although examples are found in drainage areas in Abercrombie River NP, Badja Swamps NR, Blue Mountains NP, Deua NP, Gourock NP, Kanangra-Boyd NP, Macanally SCA, Monga SCA, Mount Dowling NR, Quidong NR, Tallaganda NP, Tinderry NR, Wiarborough NR and Yanunubeyan SCA.

Extent of clearing: This community has been widely cleared across its range primarily for pastoral development.

Reference: Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

u78: Snow Gum grassy mid-high woodland of the South Eastern Highlands bioregion

Scientific Name: *Eucalyptus pauciflora* subsp. *pauciflora* ± *Eucalyptus bridgesiana* / *Astroloma humifusum* – *Hibbertia obtusifolia* / *Themeda australis* – *Microlaena stipoides* – *Poa sieberiana* – *Chrysocephalum apiculatum*

Number of samples:	27
Richness [mean (±SD)]:	31 (8)
Slope (degrees):	(0) 1–4 (8)
Altitude (m asl):	(584) 683–792 (940)
Ave. Annual Rainfall (mm):	(641) 699–798 (874)
Temp. Annual Range (°C):	(24.3) 25.6–26.2 (26.8)

Vegetation Description: Community u78 is a mid-high grassy woodland dominated by *Eucalyptus pauciflora* subsp. *pauciflora* occasionally with *Eucalyptus bridgesiana*. The shrub layer is sparse or absent, with infrequent occurrences of low shrubs such as *Pimelea curviflora*, *Astroloma humifusum*, and *Hibbertia obtusifolia* at low abundance. The groundlayer is dense and dominated by grasses such as *Themeda australis*, *Microlaena stipoides*, *Poa sieberiana*, *Elymus scaber*, *Aristida ramosa* and *Rytidosperma racemosum*. Forb species include *Chrysocephalum apiculatum*, *Gonocarpus tetragynus*, *Hypericum gramineum*, *Lomandra filiformis* subsp. *coriacea*, *Acaena echinata* and *Asperula conferta*. Heavily grazed remnants may be dominated by less-palatable species such as *Aristida ramosa*, *Rytidosperma* spp. and *Bothriochloa macra*.

Community u78 occurs on flat to undulating clay landscapes from the Crookwell area south to the Braidwood area. It is mostly found on private grazing land and as such has been highly modified and cleared across its range. It grades into tableland grassland communities such as Community r7 [*Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana*



Plate u78: Community u78 with mature and regenerating *Eucalyptus pauciflora* ssp. *pauciflora*, and a mix of grasses and forbs.

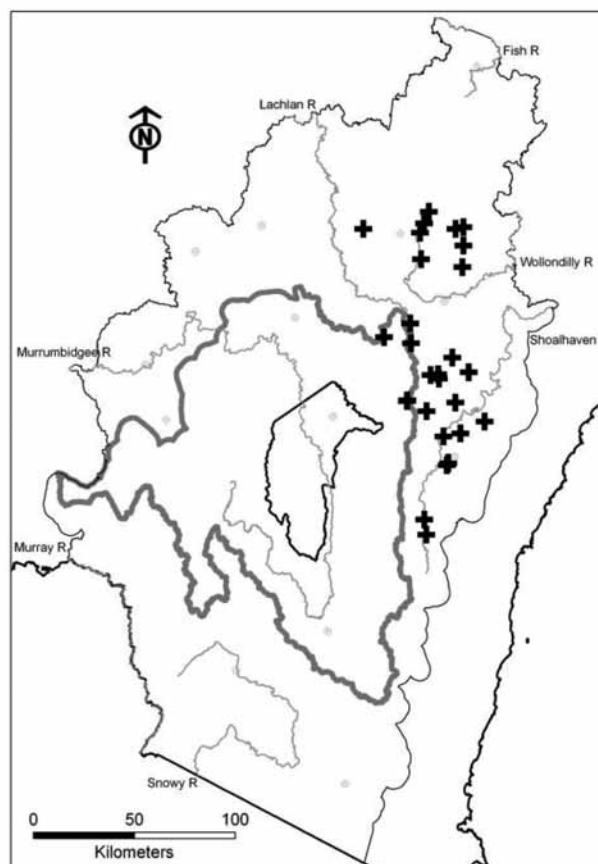


Fig. u78: Distribution of field samples assigned to this community.

moist tussock grassland of the South Eastern Highlands bioregion], which can also contain scattered occurrences of *Eucalyptus pauciflora* subsp. *pauciflora* at low abundance.

Characteristic Species:

Species	C/A	Freq	C/A	O	Freq	O	Fid
<i>Acaena echinata</i>	1	52	1	9			P
<i>Aristida ramosa</i>	2	48	2	5			P
<i>Asperula conferta</i>	1	44	1	10			P
<i>Astroloma humifusum</i>	1	33	1	5			P
<i>Bothriochloa macra</i>	1	26	1	3			P
<i>Calocephalus citreus</i>	2	22	1	<1			P
<i>Carex inversa</i>	2	37	1	8			P
<i>Chrysocephalum apiculatum</i>	2	67	1	6			P
<i>Dichelachne micrantha</i>	1	33	1	10			P
<i>Einadia nutans</i>	1	26	1	4			P
<i>Elymus scaber</i>	1	59	1	21			P
<i>Eryngium ovinum</i>	1	22	1	<1			P
<i>Eucalyptus bridgesiana</i>	2	26	3	7			P
<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>	3	89	3	20			P
<i>Hypericum gramineum</i>	2	59	1	25			P
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2	59	2	18			P
<i>Microlaena stipoides</i>	3	96	2	34			P
<i>Oxalis exilis</i>	2	22	1	5			P
<i>Panicum effusum</i>	2	41	1	3			P
<i>Pimelea curviflora</i>	2	37	1	6			P
<i>Plantago varia</i>	2	37	1	11			P
<i>Poa labillardierei</i>	2	37	2	10			P
<i>Rytidosperma laeve</i>	2	26	2	4			P
<i>Rytidosperma pilosum</i>	2	30	2	9			P
<i>Rytidosperma racemosum</i>	2	44	2	10			P
<i>Scleranthus biflorus</i>	2	37	1	10			P
<i>Solenogyne gunnii</i>	1	22	1	5			P
<i>Themeda australis</i>	3	100	2	20			P
<i>Tricoryne elatior</i>	2	41	1	4			P
<i>Wahlenbergia communis</i>	1	26	1	5			P
<i>Wahlenbergia luteola</i>	2	26	1	1			P
<i>Gonocarpus tetragynus</i>	2	63	2	48			C
<i>Hydrocotyle laxiflora</i>	2	44	2	30			C
<i>Poa sieberiana</i>	3	74	2	48			C

Threatened communities: This community is part of the TSC Act 1995 – *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes bioregions.*

Equivalent vegetation types: Given the lack of adequate previous woodland classifications, there are no clear equivalent communities. There are some affinities with p22 [*Frost Hollow Grassy Woodland*] and p24 [*Tableland Grassy Box-Gum Woodland*] as described by Tozer et al. (2010).

Frequently occurring weeds: This community is generally confined to private properties where grazing of domestic stock is the primary landuse. Typical weeds are those associated with this landuse and include *Acetosella vulgaris* (0.62), *Centaurium erythraea* (0.23), *Cirsium vulgare* (0.23), *Crataegus monogyna* (0.23), *Hypochaeris radicata* (0.85), *Plantago lanceolata* (0.58) and *Rosa rubiginosa* (0.46). Where pasture improvement has occurred *Dactylis glomerata* (0.23), *Holcus lanatus* (0.23) and *Paspalum dilatatum* (0.23) are more common.

Threats: This community was extensively cleared because it occurred on land well-suited to agricultural development. The community is now highly fragmented and remnants are subject to grazing pressures, weed invasion, firewood collection, and occasionally small-scale clearing.

Reservation status: This community is poorly reserved. Examples occur in Oakdale NR.

Extent of clearing: Clearing of this vegetation type is known to be high across its known range due to pastoral development.

Reference: Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

Formation: Grasslands

Class: Temperate Montane Grasslands

Note: Grasslands were classified through a separate analysis (Rehwinkel unpub.) to that of the woody and alpine communities, and as such CA/O (cover/abundance of taxa recorded in other communities), Freq O (frequency of taxa recorded in other communities) and Fid (fidelity) measures are not presented.

r1: Sub-montane moist tussock grassland of the South Eastern Highlands bioregion

Scientific Name: *Poa sieberiana* – *Themeda australis* – *Ranunculus lappulaceus* – *Coronidium* sp. ‘Alps’ – *Plantago gaudichaudii* – *Brachyscome scapigera*

Number of samples:	22
Richness [mean (±SD)]:	20 (5)
Slope (degrees):	(0) 2–5 (10)
Altitude (m asl):	(717) 919–1129 (1171)
Ave. Annual Rainfall (mm):	(683) 725–800 (897)
Temp. Annual Range (°C):	(25.0) 25.4–26.9 (27.7)

Vegetation Description: Community r1 is a dense moist tussock grassland dominated by *Poa sieberiana* and/or *Themeda australis* in the upper stratum with a variety of forbs in the inter-tussock spaces, including *Brachyscome scapigera*, *Asperula* spp. (*Asperula conferta* or *Asperula scoparia*), *Coronidium* sp. ‘Alps’, *Plantago antarctica*, *Hydrocotyle algida*, *Ranunculus lappaceus*, *Geranium antrorsum* and *Leptorhynchus squamatus*. Other grasses are present including *Rytidosperma* spp., *Elymus scaber* and *Hemarthria uncinata*. A variety of rushes *Juncus* spp. and sedges *Carex* spp. may also be present. Isolated or scattered trees may occur including *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus dabrympleana*, *Eucalyptus ovata* or *Acacia melanoxylon*. There may be isolated shrubs or patches of shrubs including *Hakea microcarpa*, *Discaria pubescens*, *Banksia marginata*, *Bossiaea riparia*, *Bursaria spinosa* and *Mirbelia oxylobioides*. Trees and shrubs increase in density at ecotones with adjacent woodland and forest communities. Relatively undisturbed sites may have a variety of uncommon grassland forbs, including *Prasophyllum wilkinsoniorum*, *Diplarrena moraea* and *Thysanotus tuberosus*.

This community is found on a variety of substrates but most commonly on colluvium or alluvium on footslopes and flats. It also occurs on basalt and granite lithologies and on midslopes and plateaux. Poor soil drainage, seasonal waterlogging and severe frosts drive the distribution of this community, as they restrict the establishment of woody species. Community r1 occurs in the southern ACT (Namadgi NP) and the adjacent Yaouk area in NSW. Elsewhere in NSW, it occurs near Delegate, Nunnock Swamp (South East Forests NP), Kydra River and the upper headwaters of the Shoalhaven River (Deua NP). Degraded sites (i.e. lacking some of the main species that define this community) may be difficult to distinguish from degraded sites of Community r2 [*Poa labillardierei* – *Themeda australis* – *Juncus* sp. *wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion*] or Community r7 [*Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* *moist tussock grassland of the South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq
<i>Acaena novae-zelandiae</i>	1	45
<i>Acaena ovina</i>	1	27
<i>Asperula</i> spp.	1	95

<i>Brachyscome scapigera</i>	1	59
<i>Carex</i> spp.	1	77
<i>Chrysocephalum apiculatum</i>	1	27
<i>Coronidium</i> sp. 'Alps'	1	64
<i>Craspedia</i> spp.	1	45
<i>Cynoglossum suaveolens</i>	1	27
<i>Elymus scaber</i>	1	36
<i>Epilobium</i> spp.	1	41
<i>Euchiton</i> spp.	1	23
<i>Geranium antrorsum</i>	1	55
<i>Geranium</i> spp.	1	59
<i>Hemarthria uncinata</i>	1	23
<i>Hydrocotyle laxiflora</i>	1	41
<i>Juncus</i> spp.	1	73
<i>Leptorhynchus squamatus</i>	1	55
<i>Lomandra longifolia</i>	1	32
<i>Luzula</i> spp.	1	23
<i>Microlaena stipoides</i>	1	27
<i>Oreomyrrhis eriopoda</i>	1	32
<i>Oxalis perennans</i>	1	36
<i>Plantago antarctica</i>	1	45
<i>Plantago gaudichaudii</i>	1	64
<i>Poa labillardierei</i>	1	23
<i>Poa sieberiana</i>	4	100
<i>Ranunculus lappaceus</i>	1	68
<i>Rumex brownii</i>	1	73
<i>Rytidosperma</i> spp.	1	59
<i>Scleranthus biflorus</i>	1	45
<i>Solenogyne gunnii</i>	1	36
<i>Stylidium graminifolium sens. lat.</i>	1	36
<i>Themeda australis</i>	3	100
<i>Veronica gracilis</i>	1	41
<i>Viola betonicifolia</i>	1	32
<i>Wahlenbergia</i> spp.	1	27



Plate r1: *Poa sieberiana* and *Themeda australis* dominate this forb-rich example of Community r1 in the Jerrabatgulla Creek area south of Braidwood.

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*; NC Act 1980 – *Natural Temperate Grassland*.

Equivalent vegetation types: This community is equivalent to Group 1 (Rehwinkel unpub.).

Frequently occurring weeds: The naturally open nature of this community made it highly attractive to pastoral management. Common weeds are those typical of other grassy ecosystems of the region, including *Anthoxanthum odoratum*, *Hypochaeris radicata* and *Acetosella vulgaris*.

Threats: This community has been extensively cleared and remnants are subject to continued small-scale clearing, weed invasion and grazing pressures.

Reservation status: Poorly reserved. Occurs in Deua NP, Namadgi NP, South East Forests NP and Yaouk NR. Also on Nature Conservation Trust covenanted lands in the upper Shoalhaven River area.

Extent of clearing: Unknown, although throughout its range only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report.

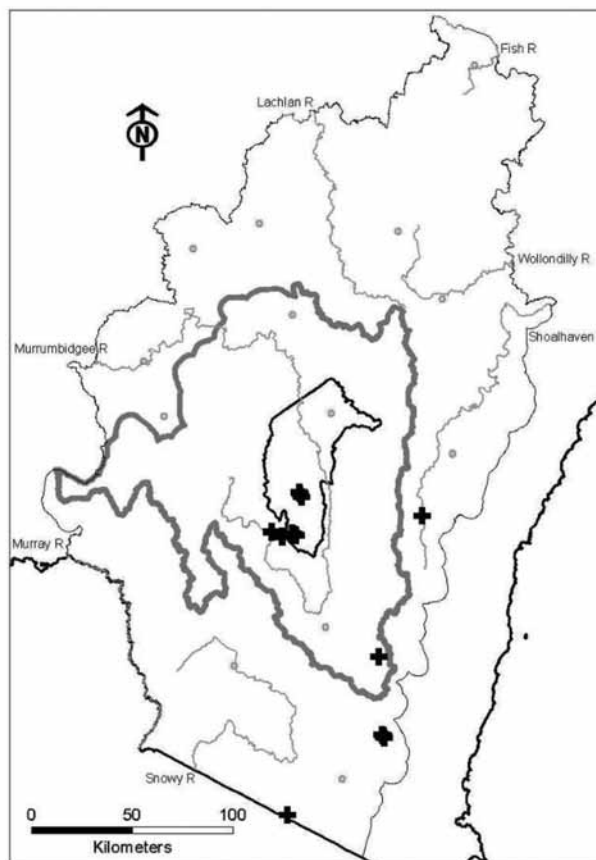


Fig. r1: Distribution of field samples assigned to this community.

r2: *Poa labillardierei* – *Themeda australis* – *Juncus* sp. wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion

Scientific Name: *Poa labillardierei* – *Themeda australis* – *Juncus* spp.

Number of samples:	45
Richness [mean (±SD)]:	17 (3)
Slope (degrees):	(0) 2–6 (15)
Altitude (m asl):	(562) 608–857 (1313)
Ave. Annual Rainfall (mm):	(526) 649–731 (877)
Temp. Annual Range (°C):	(24.9) 26.5–27.7 (28.8)

Vegetation Description: Community r2 is a tall, dense or mid-dense wet tussock grassland dominated by *Poa labillardierei* usually with *Themeda australis*, the sedge *Carex appressa* and rush *Juncus* spp. in the upper stratum and a variety of grasses and forbs in the intertussock spaces, including *Microlaena stipoides*, *Rytidosperma* spp., *Elymus scaber*, *Acaena ovina*, *Asperula* spp. (*Asperula conferta* or *Asperula scoparia*), *Euphrasia* spp., *Coronidium* sp. ‘Alps’ and *Hemarthria uncinata*. Isolated or scattered trees may be present, including *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus viminalis*, *Eucalyptus rubida*, *Eucalyptus stellulata*, *Eucalyptus aggregata*, *Eucalyptus bridgesiana*, *Acacia dealbata*, *Acacia mearnsii* or *Acacia melanoxylon*. Isolated shrubs or patches of shrubs may also occur including *Kunzea parvifolia*, *Melaleuca parvistaminea*, *Astroloma humifusum*, *Einadia nutans* and *Hakea microcarpa*. Trees and shrubs increase in density where this community merges into the adjacent woodland communities. Relatively undisturbed sites may have a variety of uncommon grassland forbs including *Craspedia* spp., *Geranium antrorsum*, *Calocephalus citreus*, *Ranunculus lappaceus* and *Brachyscome decipiens*.

Community r2 is found on colluvium or alluvium and on drainage lines in footslopes and particularly on the broad flats associated with creeks and rivers. Poor soil drainage associated with frequent seasonal waterlogging and, to a lesser degree winter frosts, drive the distribution of this community as they restrict the establishment of woody taxa. It is distributed widely across the region wherever suitable habitat exists. Degraded sites (i.e. lacking some of the main diagnostic taxa) may be confused with degraded examples of Community r3 [*Rytidosperma* sp. – *Themeda australis* – *Juncus* sp. tussock grassland of occasionally wet sites of the South Eastern Highlands bioregion] or Community r7 [*Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* moist tussock grassland of the South Eastern Highlands bioregion].

Characteristic Species:

Species	C/A	Freq
<i>Acaena novae-zelandiae</i>	1	25
<i>Acaena ovina</i>	1	44
<i>Aristida</i> spp.	1	21
<i>Asperula</i> spp.	1	44
<i>Carex appressa</i>	1	42
<i>Carex</i> spp.	1	38
<i>Coronidium</i> sp. ‘Alps’	1	31
<i>Craspedia</i> spp.	1	21
<i>Elymus scaber</i>	1	44
<i>Epilobium</i> spp.	1	38
<i>Eragrostis</i> spp.	1	27
<i>Euchiton</i> spp.	1	40
<i>Geranium</i> spp.	1	33
<i>Hemarthria uncinata</i>	1	23
<i>Hydrocotyle algida</i>	1	29
<i>Hypericum gramineum</i>	1	25
<i>Juncus</i> spp.	2	81
<i>Lachnagrostis</i> spp.	1	27



Plate r2: Tall tussocks of *Poa labillardierei* dominate this example of Community site on the Molonglo River, while grasses and forbs characteristic of wetter areas occupy the inter-tussock spaces.

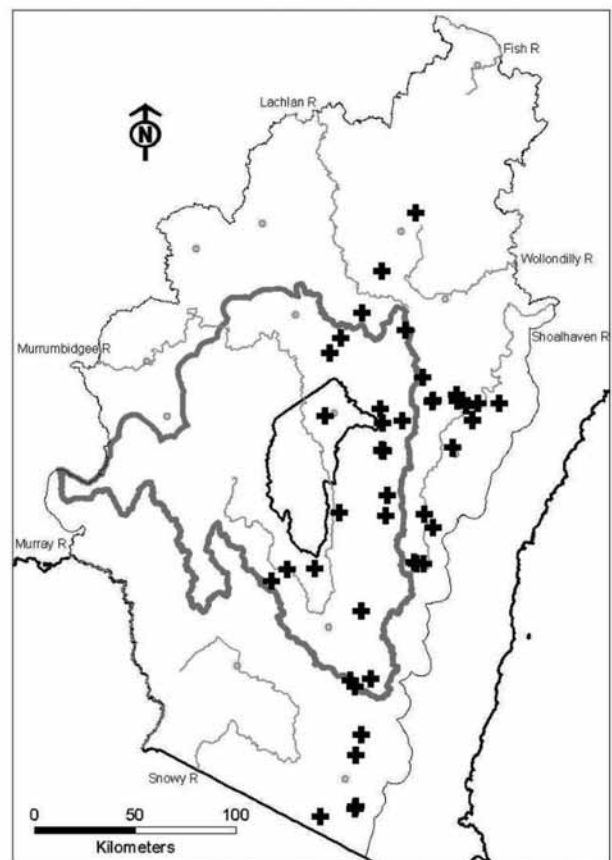


Fig. r2: Distribution of field samples assigned to this community.

<i>Leptorhynchos squamatus</i>	1	23
<i>Microlaena stipoides</i>	1	42
<i>Oxalis perennans</i>	1	31
<i>Panicum effusum</i>	1	23
<i>Persicaria prostrata</i>	1	21
<i>Poa labillardierei</i>	5	94
<i>Poa meionectes</i>	1	25
<i>Rumex brownii</i>	1	38
<i>Rytidosperma</i> spp.	1	44
<i>Schoenus apogon</i>	1	21
<i>Scleranthus biflorus</i>	1	31
<i>Solenogyne gunnii</i>	1	23
<i>Themeda australis</i>	3	67

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*; NC Act 1980 – *Natural Temperate Grassland*.

Equivalent vegetation types: Community 8 (Benson 1994); Group 2 (Rehwinkel unpub.); Draft VCA 635 [*Tall wet tussock grassland on footslopes, depressions and flats of the South Eastern Highlands bioregion*] (Benson in prep.)

Frequently occurring weeds: Because this grassland community occurs on sites of high soil fertility, it has a long history of grazing, clearing and exotic pasture introduction. The most frequently recorded species within this community are *Hypochaeris radicata*, *Acetosella vulgaris*, *Phalaris aquatica*, *Holcus lanatus*, *Bromus* spp., *Vulpia* spp., *Festuca arundinacea* and *Paspalum dilatatum*, which are all typical of heavily grazed sites on fertile soil.

Threats: This community has been extensively cleared and remnants are subject to nutrient run-on from adjacent fertilised crops and pastures, small-scale clearing, weed invasion and grazing pressures.

Reservation status: Poorly reserved. Occurs in Deua NP, Tinderry NR and Yaouk NR, with a very minor occurrence at Turallo NR. It is also found on Nature Conservation Trust covenanted land in the upper Shoalhaven River, and at the Scottsdale Bush Heritage Reserve near Cooma.

Extent of clearing: Clearing figures are unavailable for grassland communities. Throughout its range only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Benson, J.S. (1994) The native grasslands of the Monaro region: southern tablelands of New South Wales. *Cunninghamia* 3: 609–650; Benson, J.S. (in prep.) New South Wales vegetation classification and assessment: Part 4. Plant communities of the west South Eastern Highlands and Australian Alps bioregions. Botanic Gardens Trust, Sydney; Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report.

r3: *Rytidosperma* sp. – *Themeda australis* – *Juncus* sp. tussock grassland of occasionally wet sites of the South Eastern Highlands bioregion

Scientific Name: *Rytidosperma* spp. – *Themeda australis* – *Juncus* spp. – *Schoenus apogon* – *Haloragis heterophylla* – *Lachnagrostis* spp.

Number of samples:	15
Richness [mean (±SD)]:	22 (8)
Slope (degrees):	(0) 0–2 (5)
Altitude (m asl):	(586) 644–713 (860)
Ave. Annual Rainfall (mm):	(593) 666–746 (984)
Temp. Annual Range (°C):	(27.0) 27.9–28.5 (29.4)

Vegetation Description: Community r3 is a dense to mid-dense, low to mid-high tussock grassland dominated by wallaby-grasses (*Rytidosperma* spp.) and/or *Themeda australis*, with rushes (*Juncus* spp.) in the upper stratum and a variety of smaller grasses, sedges and forbs in the lower stratum. Lower stratum species include *Lachnagrostis* spp., *Schoenus apogon*, *Haloragis heterophylla*, *Hydrocotyle algida*, *Carex appressa*, *Amphibromus* spp. and *Elymus scaber*. Isolated or scattered trees may be present, including *Eucalyptus ovata*, *Eucalyptus rubida* and *Eucalyptus pauciflora* subsp. *pauciflora*. Trees increase in density at ecotones with adjacent woodland or (rarely) forest communities. Relatively undisturbed sites have a variety of uncommon grassland forbs including *Craspedia* spp., *Dichopogon fimbriatus*, *Montia australasica* and *Calotis anthemoides*.

This community is found most commonly on flats on or adjacent drainage lines or wetlands, and occasionally on footslope and midslope situations. Substrates are colluvium or alluvium derived from sedimentary or granite parent material. Poor soil drainage associated with frequent seasonal waterlogging and severe winter frosts drive the distribution of this community, as they restrict the establishment of woody taxa. This community occurs in the Bondo and Murrumbateman subregions of the South Eastern Highlands bioregion and the upper Shoalhaven valley. Degraded sites (i.e. lacking some of the main diagnostic taxa) may be confused with degraded examples of Community r2 [*Poa labillardierei* – *Themeda australis* – *Juncus* sp. *wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion*], although Community r3 generally occurs on drier sites than those occupied by Community r2. Community r7 [*Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* *moist tussock grassland of the South Eastern Highlands bioregion*] is another grassland community with which Community r3 frequently co-occurs.

Characteristic Species:

Species	C/A	Freq
<i>Acaena ovina</i>	1	29
<i>Amphibromus</i> spp.	1	48
<i>Asperula</i> spp.	1	43
<i>Austrostipa bigeniculata</i>	1	24
<i>Calotis anthemoides</i>	1	24
<i>Carex appressa</i>	1	57
<i>Carex</i> spp.	1	57
<i>Coronidium</i> sp. ‘Alps’	1	33
<i>Craspedia</i> spp.	1	33
<i>Cynodon dactylon</i>	1	33
<i>Deyeuxia quadriseta</i>	1	24
<i>Dichelachne</i> spp.	1	33
<i>Dichopogon fimbriatus</i>	1	29
<i>Drosera peltata</i>	1	48
<i>Elymus scaber</i>	1	62
<i>Epilobium</i> spp.	1	52
<i>Eragrostis</i> spp.	1	43
<i>Euchiton</i> spp.	2	90



Plate r3: Occupying a seasonally moist zone between the wetland and a dryer area occupied by Community r7, this moist Community r3 site adjacent to Rows Lagoon is dominated by *Themeda australis*, *Rytidosperma* spp. and a suite of other moisture-loving grasses and forbs.

<i>Gonocarpus tetragynus</i>	1	24
<i>Haloragis heterophylla</i>	2	81
<i>Hemarthria uncinata</i>	1	33
<i>Hydrocotyle algida</i>	2	62
<i>Hypericum gramineum</i>	1	48
<i>Hypoxis</i> spp.	1	33
<i>Isotoma fluviatilis</i>	1	33
<i>Juncus</i> spp.	3	95
<i>Lachnagrostis</i> spp.	2	67
<i>Luzula</i> spp.	1	43
<i>Lythrum hyssopifolia</i>	1	57
<i>Microlaena stipoides</i>	1	48
<i>Microtis</i> spp.	1	38
<i>Montia australasica</i>	1	29
<i>Oxalis perennans</i>	1	38
<i>Pericaria prostrata</i>	1	29
<i>Poa labillardierei</i>	1	38
<i>Poa sieberiana</i>	1	43
<i>Rumex brownii</i>	1	67
<i>Rytidosperma</i> spp.	4	100
<i>Schoenus apogon</i>	2	81
<i>Themeda australis</i>	3	67
<i>Triptilodiscus pygmaeus</i>	1	24
<i>Wahlenbergia</i> spp.	1	52
<i>Wurmbea dioica</i>	1	24

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*; NC Act 1980 – *Natural Temperate Grassland*.

Equivalent vegetation types: Group 3 (Rehwinkel unpub.), Draft VCA 637 [Wallaby Grass – Blown Grass – Rush moist tussock grassland of seasonally wet sites in the South Eastern Highlands bioregion] (Benson in prep.).

Frequently occurring weeds: The weeds *Anthoxanthum odoratum*, *Hypochaeris radicata*, *Acetosella vulgaris*, *Holcus lanatus*, *Paspalum dilatatum*, *Festuca arundinacea*, *Vulpia* spp. and *Phalaris aquatica* were common in this community

Threats: This community has been extensively cleared and remnants are subject to small-scale clearing, weed invasion, grazing pressures, and nutrient run-on from adjacent fertilised crops and pastures.

Reservation status: Poorly reserved. There is a very minor occurrence at Turallo NR and at Mulligans Flat NR.

Extent of clearing: Unknown, although throughout its range, only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Benson, J.S. (in prep.) New South Wales vegetation classification and assessment: Part 4. Plant communities of the west South Eastern Highlands and Australian Alps bioregions. Botanic Gardens Trust, Sydney; Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report.

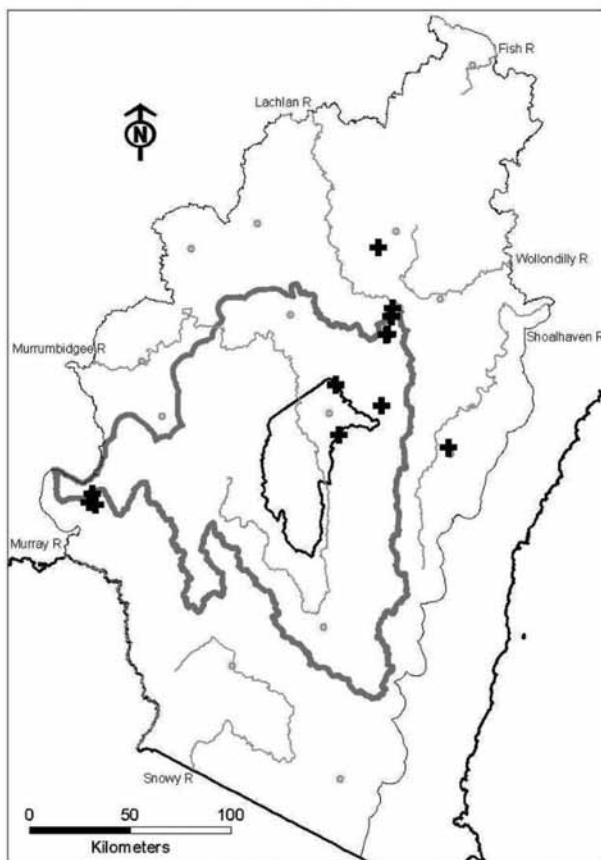


Fig. r3: Distribution of field samples assigned to this community.

r4: Lacustrine grass-forbland of the South Eastern Highlands bioregion

Scientific Name: *Lachnagrostis* spp. – *Wilsonia rotundifolia*
– *Carex bichenoviana* – *Selliera radicans* – *Juncus* spp.

Number of samples:	5
Richness [mean (±SD)]:	10 (5)
Slope (degrees):	(0) 0–0 (0)
Altitude (m asl):	(709) 709–709 (709)
Ave. Annual Rainfall (mm):	(629) 637–650 (657)
Temp. Annual Range (°C):	(28.1) 28.1–28.2 (28.2)

Vegetation Description: Community r4 is a variable lake-margin and dry lake-bed vegetation type with structure and composition varying in response to lake wetting and drying cycles. Structure ranges from very open to dense, low to mid-high, forbland to tussock grassland, sometimes with patches of sedgeland. Dominant species include *Lachnagrostis* spp., *Carex bichenoviana* and *Juncus* spp. in the upper stratum, and a variety of forbs and shorter grasses in the lower stratum including *Wilsonia rotundifolia*, *Selliera radicans*, *Dichondra repens*, *Ranunculus diminitus*, *Cynodon dactylon*, *Chenopodium glaucum*, *Rytidosperma* spp., *Lythrum hyssopifolia*, *Panicum effusum* and *Centella asiatica*. During shallow inundation the forbs *Wilsonia rotundifolia*, *Selliera radicans* and *Ranunculus diminitus* may survive for extended periods, including their underground parts, re-emerging first during drying phases to create a dense forbland. *Wilsonia rotundifolia* and *Selliera radicans* are particularly prevalent in brackish lakes such as Lake George and Lake Bathurst. Grasses (particularly *Lachnagrostis* spp.) and forbs characteristic of drier habitats re-colonise drying lake margins over time. Dry phases may last in excess of ten years, occasionally allowing establishment of eucalypt saplings.

The five samples used to define this community were from the bed and foreshores of Lake George. Community r4 is also known from similar broad lake beds of Lake Bathurst, the margins of Rowes Lagoon and some lakes of the Monaro. The beds of these tableland lakes are alluvial mud, silt and sand. The combined factors of seasonal waterlogging, cracking clays, extended dry periods and severe winds limit the establishment of woody taxa. The Lake Bathurst example is distinct in that it has isolated populations of *Dodonaea procumbens*, *Pelargonium* sp. *Striatellum* (G. W. Carr 10345), *Schoenus nitens*, *Rulingia prostrata* and the only NSW record of *Lawrenca spicata*. Rowes Lagoon is distinct in that it has an isolated population of *Rulingia prostrata* and several daisies including *Chrysocephalum apiculatum*, *Calocephalus citreus* and *Leptorhynchus squamatus*. This community may also form on some of the Monaro lakes when they are dry. Populations of *Pelargonium* sp. *Striatellum* (G. W. Carr 10345) have been recorded on at least two of the Monaro lakes belonging to this community.

At ecotones between drier sites, Community r4 may merge with Community r3 [*Rytidosperma* sp. – *Themeda australis* – *Juncus* sp. tussock grassland of occasionally wet sites of the South Eastern Highlands bioregion], which occurs above the shorelines of Rowes Lagoon and Breadalbane Lagoon. When inundated for extended periods, sites occupied by Community r4 are most likely to become Community L12 [*Freshwater sedge-herb marsh of shallow, commonly inundated wetlands of the eastern South Eastern Highlands bioregion*] or, when significantly deeper, Community L4 [*Freshwater sedge-herb marsh of deep semi-permanent and/or slightly saline wetlands of the eastern South Eastern Highlands bioregion*].



Plate r4: During long droughts, the dry lakebed of Lake George is occupied by Community r4, dominated by *Lachnagrostis filiformis* and 9.

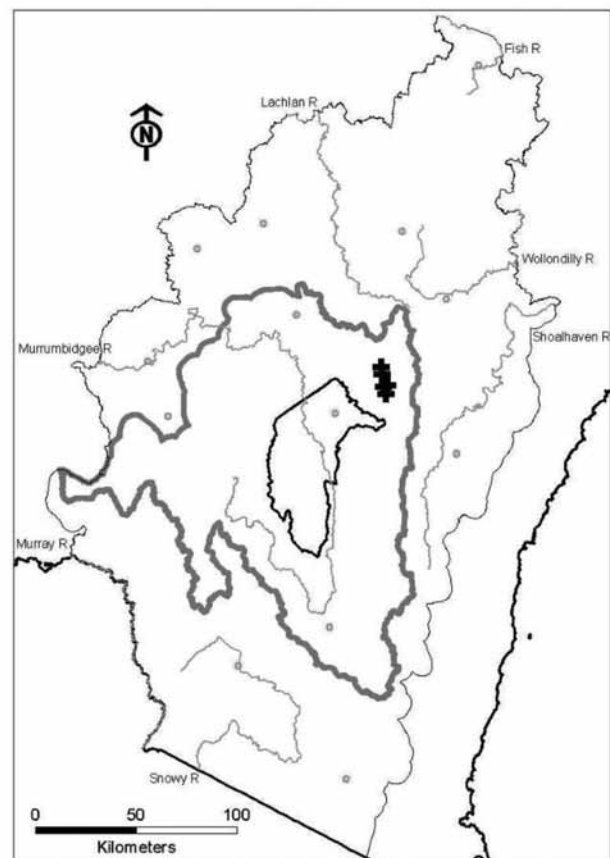


Fig. r4: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq
<i>Bothriochloa macra</i>	1	20
<i>Brachyscome graminea</i>	1	20
<i>Carex bichenoviana</i>	3	80
<i>Centella asiatica</i>	1	20
<i>Chenopodium glaucum</i>	1	60
<i>Chloris truncata</i>	1	20
<i>Convolvulus angustissimus</i>	1	20
<i>Cynodon dactylon</i>	1	60
<i>Dichondra repens</i>	1	40
<i>Epilobium</i> spp.	1	40
<i>Juncus</i> spp.	2	60
<i>Lachnagrostis</i> spp.	4	100
<i>Lythrum hyssopifolia</i>	1	40
<i>Panicum effusum</i>	1	20
<i>Pennisetum alopecuroides</i>	1	20
<i>Persicaria prostrata</i>	1	20
<i>Ranunculus diminitus</i>	1	80
<i>Rumex brownii</i>	1	40
<i>Rytidosperma</i> spp.	1	40
<i>Selliera radicans</i>	2	80
<i>Wilsonia rotundifolia</i>	3	100

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*.

Equivalent vegetation types: Identified by Rehwinkel (unpub.) as Group 4. In its wetland state, this community is equivalent to p51 [*Tableland Lacustrine Herbfield*] identified by Tozer et al. (2010). Recognised as Draft VCA 636 [*Lacustrine Ephemeral Grassland of the South Eastern Highlands bioregion*] (Benson in prep).

Frequently occurring weeds: An unusual suite of weed species has been recorded for this community, reflecting not only its disturbance history but also its unique lacustrine environment. The most frequently recorded species are *Aster subulatus*, *Nassella dichotoma*, *Nassella neesiana*, *Hypochaeris radicata*, *Plantago coronopus* and *Polygonum aviculare*.

Threats: The community is subject to continuing grazing pressures at all sites, and is severely threatened by weed invasion at Lake Bathurst. At this location, recent and ongoing weed control is threatening some native components.

Reservation status: Not known to occur in any conservation reserves.

Extent of clearing: Unknown, although throughout its range, only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Benson, J.S. (in prep.) New South Wales vegetation classification and assessment: Part 4. Plant communities of the west South Eastern Highlands and Australian Alps bioregions. Botanic Gardens Trust, Sydney; Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report; Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. & Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

r5: *Rytidosperma* sp. – *Austrostipa bigeniculata* – *Chrysocephalum apiculatum* tussock grassland of the South Eastern Highlands bioregion

Scientific Name: *Rytidosperma* spp. – *Austrostipa bigeniculata* – *Bothriochloa macra* – *Lomandra bracteata* – *Themeda australis* – *Chrysocephalum apiculatum*

Number of samples:	82
Richness [mean (±SD)]:	22 (6)
Slope (degrees):	(0) 1–4 (22)
Altitude (m asl):	(456) 568–709 (1021)
Ave. Annual Rainfall (mm):	(521) 611–658 (711)
Temp. Annual Range (°C):	(26.6) 27.9–28.3 (30.0)

Vegetation Description: Community r5 is a mid-dense to dense, low to tall tussock grassland dominated by *Rytidosperma* spp. (mainly *Rytidosperma carphoides* and *Rytidosperma auriculatum*), *Bothriochloa macra*, *Austrostipa bigeniculata* and *Themeda australis*. *Chrysocephalum apiculatum* and *Lomandra bracteata* are common components of the lower stratum. Other grasses and forbs are present, including *Panicum effusum*, *Plantago varia*, *Austrostipa scabra*, *Elymus scaber*, *Goodenia pinnatifida*, *Triptilodiscus pygmaeus*, *Calocephalus citreus*, *Schoenus apogon* and *Tricoryne elatior*. One of the very few NSW populations of *Lepidium hyssopifolium* is found in this community.

Isolated or scattered trees and tall shrubs may be present including *Eucalyptus melliodora*, *Eucalyptus blakeyi*, *Eucalyptus rubida*, *Eucalyptus bridgesiana*, *Eucalyptus pauciflora* subsp. *pauciflora* or *Acacia dealbata*. Smaller shrubs may occur including *Lissanthe strigosa*, *Daviesia genistifolia*, *Melichrus urceolatus* and *Acacia genistifolia*. Trees and shrubs increase in density where this community merges with the adjacent woodland communities. Relatively undisturbed sites have a variety of uncommon grassland forbs, including *Eryngium ovinum*, *Tricoryne elatior*, *Calocephalus citreus*, *Pimelea curviflora*, *Rutidosis leptorrhynchoides*, *Wurmbea dioica*, *Microtis* spp., *Dichopogon fimbriatus*, *Bulbine bulbosa* and *Calotis anthemoides*.

Community r5 is found on a variety of topographic situations, including footslopes, midslopes and flats and on a variety of substrates, including sedimentary strata, colluvium, alluvium or granite. The combined factors of severe winter and spring frosts, exposure to hot drying westerly winds in summer, and to a lesser degree seasonal waterlogging and cracking clays, limit the establishment of woody taxa in this community. This grassland is mainly found in the Murrumbateman subregion, but is also found in the Shoalhaven River valley. Degraded sites (i.e. lacking some of the main species that define this community) may be difficult to distinguish from degraded examples of Community r3 [*Rytidosperma* sp. – *Themeda australis* – *Juncus* sp. tussock grassland of occasionally wet sites of the South Eastern Highlands bioregion] or Community r7 [*Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* moist tussock grassland of the South Eastern Highlands bioregion].

Characteristic Species:

Species	C/A	Freq
<i>Acaena ovina</i>	1	54
<i>Aristida</i> spp.	1	22
<i>Asperula conferta</i>	1	43
<i>Austrostipa bigeniculata</i>	3	85
<i>Austrostipa scabra</i>	1	43
<i>Bothriochloa macra</i>	3	84
<i>Calocephalus citreus</i>	1	36
<i>Chloris truncata</i>	1	35
<i>Chrysocephalum apiculatum</i>	3	80
<i>Convolvulus angustissimus</i>	1	52
<i>Desmodium varians</i>	1	42
<i>Dichondra repens</i>	1	20

<i>Elymus scaber</i>	1	58
<i>Eryngium ovinum</i>	1	68
<i>Euchiton involucrat</i>	1	26
<i>Glycine tabacina</i>	1	27
<i>Goodenia pinnatifida</i>	1	58
<i>Hypericum gramineum</i>	1	21
<i>Juncus</i> spp.	1	27
<i>Leptorhynchos squamatus</i>	1	25
<i>Lomandra bracteata</i>	2	80
<i>Microlaena stipoides</i>	1	26
<i>Oxalis perennans</i>	1	48
<i>Panicum effusum</i>	1	64
<i>Plantago varia</i>	1	56
<i>Poa sieberiana</i>	1	32
<i>Rumex brownii</i>	1	59
<i>Rumex dumosus</i>	1	21
<i>Rytidosperma carphoides</i>	2	46
<i>Rytidosperma</i> spp.	4	96
<i>Schoenus apogon</i>	1	33
<i>Solenogyne dominii</i>	1	23
<i>Themeda australis</i>	2	64
<i>Tricoryne elatior</i>	1	44
<i>Triptilodiscus pygmaeus</i>	1	46
<i>Vittadinia muelleri</i>	1	59
<i>Wahlenbergia</i> spp.	1	73



Plate r5: On dry sites in regions from the ACT and northwards, such as here at Queanbeyan Nature Reserve, Community r5 is generally dominated or co-dominated by *Austrostipa* spp., *Rytidosperma* spp. and *Bothriochloa macra*, with the most common forbs being *Chrysocephalum apiculatum* and several *Lomandra* spp.

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*; NC Act 1980 – *Natural Temperate Grassland*.

Equivalent vegetation types: Community 1 (Benson 1994), Group 5 (Rehwinkel unpub.).

Frequently occurring weeds: The most frequently recorded weed species in this community include a number of common pasture weeds, but also some of the most damaging noxious weeds in the State. These include *Eragrostis curvula*, *Nassella trichotoma*, *Hypericum perforatum*, *Nassella neesiana*, *Hypochaeris radicata*, *Acetosella vulgaris*, *Vulpia* spp., *Cirsium vulgare* and *Phalaris aquatica*.

Threats: This community has been extensively cleared and remnants are subject to small-scale clearing, grazing pressures and nutrient run-on from adjacent fertilised crops and pastures. The abundance of several noxious weeds within this community is an indication of past disturbance, but also highlights the importance of managing against future impacts, particularly to native species diversity and cover.

Reservation status: Poorly reserved in NSW. Known from Queanbeyan NR and Dunlop NR. It is also informally reserved at Days Hill Reserve (a local government reserve at Bungendore).

Extent of clearing: Unknown, although throughout its range, only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Benson, J.S. (1994) The native grasslands of the Monaro region: southern tablelands of New South Wales. *Cunninghamia* 3: 609–650; Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report.

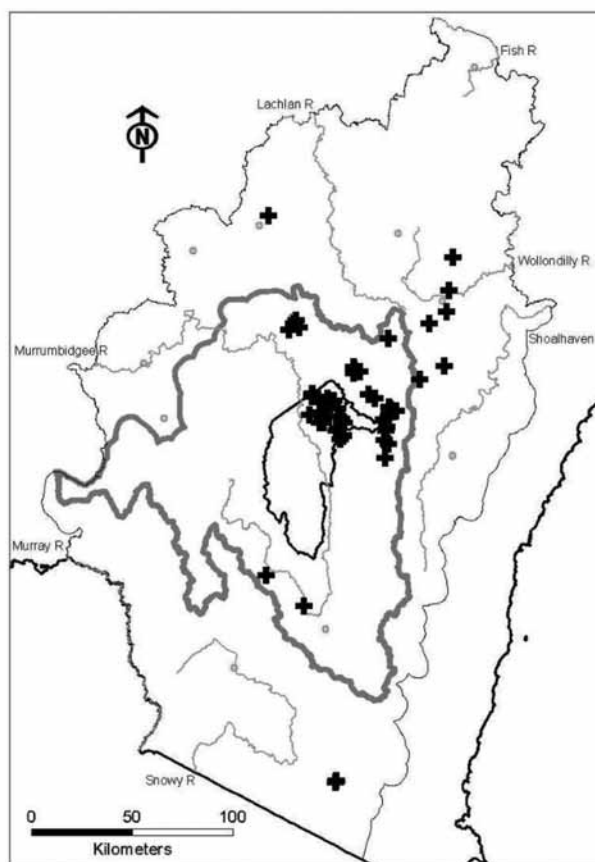


Fig. r5: Distribution of field samples assigned to this community.

r6: Dry tussock grassland of the Monaro in the South Eastern Highlands bioregion

Scientific Name: *Poa sieberiana* – *Rytidosperma* spp. – *Themeda australis* – *Austrostipa scabra* – *Acaena ovina* – *Asperula conferta* – *Chrysocephalum apiculatum*

Number of samples:	110
Richness [mean (±SD)]:	22 (6)
Slope (degrees):	(0) 2–6 (13)
Altitude (m asl):	(674) 866–1016 (1206)
Ave. Annual Rainfall (mm):	(496) 518–612 (765)
Temp. Annual Range (°C):	(25.9) 27.3–28.2 (29.5)

Vegetation Description: Community r6 is an open to dense, mid-high to tall tussock grassland dominated by one or more of the following in the upper stratum: *Poa sieberiana*, *Rytidosperma* spp., *Themeda australis*, *Austrostipa scabra* and *Austrostipa bigeniculata*. There is a diversity of forbs and other grasses in the inter-tussock spaces, including *Chrysocephalum apiculatum*, *Acaena ovina*, *Asperula conferta*, *Wahlenbergia* spp., *Scleranthus diander*, *Elymus scaber*, *Plantago varia*, *Poa meionectes*, *Bothriochloa macra*, *Brachyscome heterodonta*, *Enneapogon nigricans* and *Leptorhynchus squamatus*. Isolated or scattered trees may be present, including *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus lacrimans*, *Acacia dealbata* or *Acacia rubida*. Isolated patches of shrubs may also occur, generally containing *Einadia nutans*, *Melicytus* sp. ‘Snowfields’, *Cryptandra amara*, *Pimelea glauca*, *Discaria pubescens*, *Mirbelia oxylobioides* and *Dodonaea procumbens*. Trees and shrubs increase in density in ecotones with adjacent woodland communities or on rocky sites. Relatively undisturbed sites have a variety of uncommon grassland forbs including *Geranium antrorsum*, *Rutidosis leiolepis*, *Swainsona sericea*, *Cullen tenax*, *Pimelea curviflora* and *Stackhousia monogyna*.

This community is found on a variety of substrates; most commonly on basalt and sedimentary strata, occasionally occurring on granite, and rarely on colluvium or alluvium. It commonly occurs on midslope, upslope and plateau situations, and rarely on footslopes and flats. It occurs within the drier portions of the Monaro region, commonly referred to as the Monaro rainshadow. Severe winter and spring frosts, exposure to hot drying westerly winds in summer, periodic snow and the occurrence of cracking clays (particularly on colluvial soils derived from basalt) all serve to limit the establishment of woody taxa in this community. Community r2 [*Poa labillardierei* – *Themeda australis* – *Juncus* sp. *wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion*] may be found in moist depressions and drainage lines adjacent to this community. Sites along the wetter fringe of the region, especially degraded sites (i.e. lacking some of the main species that define this community) may be confused with degraded examples of Community r7 [*Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* *moist tussock grassland of the South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq
<i>Acaena ovina</i>	2	87
<i>Asperula conferta</i>	2	81
<i>Austrostipa bigeniculata</i>	1	44
<i>Austrostipa scabra</i>	2	70
<i>Bothriochloa macra</i>	1	42
<i>Brachyscome heterodonta</i>	1	60
<i>Brachyscome rigidula</i>	1	25
<i>Carex</i> spp.	1	57
<i>Chrysocephalum apiculatum</i>	3	81
<i>Convolvulus angustissimus</i>	1	75
<i>Crassula sieberiana</i>	1	30
<i>Cryptandra amara</i>	1	24
<i>Cullen tenax</i>	1	23
<i>Cymbonotus lawsonianus</i>	1	35



Plate r6: Typical of the dry rain-shadow regions of the Monaro, such as here at Kuma Nature Reserve south of Cooma, Community r6 sites are dominated by *Poa sieberiana* and, in undisturbed areas, *Themeda australis*. A characteristic suite of forbs and shrubs include *Rutidosis leiolepis*, *Calotis glandulosa*, *Dodonaea procumbens* and *Melicytus* sp. ‘Snowfields’.

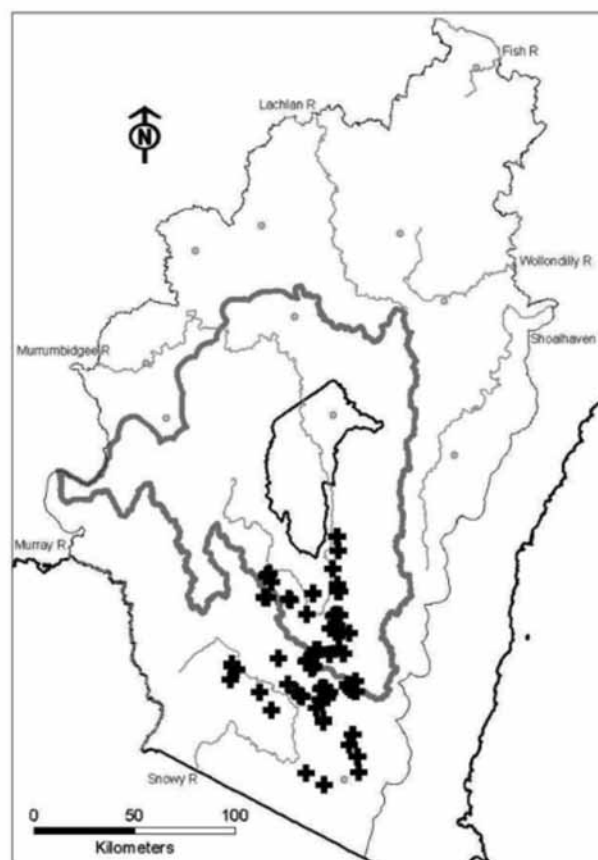


Fig. r6: Distribution of field samples assigned to this community.

<i>Desmodium varians</i>	1	28
<i>Dichelachne</i> spp.	1	29
<i>Dichondra repens</i>	1	25
<i>Dichondra</i> sp.A	1	39
<i>Einadia nutans</i>	1	27
<i>Elymus scaber</i>	2	72
<i>Enneapogon nigricans</i>	1	52
<i>Epilobium</i> spp.	1	37
<i>Euchiton</i> spp.	1	20
<i>Geranium antrorsum</i>	1	47
<i>Glycine clandestina</i>	1	21
<i>Glycine tabacina</i>	1	22
<i>Goodenia pinnatifida</i>	1	22
<i>Leptorhynchos squamatus</i>	1	40
<i>Melicytus</i> sp. 'Snowfields'	1	27
<i>Oxalis perennans</i>	1	47
<i>Pimelea curviflora</i>	1	21
<i>Pimelea glauca</i>	1	22
<i>Poa meionectes</i>	1	51
<i>Poa sieberiana</i>	4	94
<i>Rumex brownii</i>	1	49
<i>Rytidosperma</i> spp.	3	96
<i>Scleranthus biflorus</i>	1	33
<i>Scleranthus diander</i>	2	65
<i>Solenogyne gunnii</i>	1	30
<i>Stackhousia monogyna</i>	1	20
<i>Swainsona sericea</i>	1	33
<i>Themeda australis</i>	3	71
<i>Vittadinia cuneata</i>	1	37
<i>Vittadinia muelleri</i>	2	73
<i>Vittadinia triloba</i>	1	39
<i>Wahlenbergia</i> spp.	2	82

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*.

Equivalent vegetation types: Group 6 (Rehwinkel unpub.), which includes Sub-groups 6a, 6b and 6c. These subgroups correspond with Benson (1994) Communities 4, 3b and 3a respectively. The higher diversity components of Community 5 (Benson 1994) also occur in this community.

Frequently occurring weeds: Like Community r5, the most frequently recorded weed species in this community include several common pasture weeds, as well as a number of noxious weeds. These include *Eragrostis curvula*, *Nassella trichotoma*, *Hypericum perforatum*, *Hypochaeris radicata*, *Acetosella vulgaris*, *Vulpia* spp., *Cirsium vulgare* and *Onopordum acanthium*.

Threats: This community has been extensively cleared and/or modified with remnants subject to small-scale clearing, weed invasion and grazing pressures.

Reservation status: Poorly reserved. Occurs in Kuma NR south-east of Cooma and Namadgi NP. Informally reserved at Old Cooma Common and at the Bush heritage Australia reserve, Scottsdale.

Extent of clearing: Unknown, although throughout its range, only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Benson, J.S. (1994) The native grasslands of the Monaro region: southern tablelands of New South Wales. *Cunninghamia* 3: 609–650; Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report.

r7: *Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* moist tussock grassland of the South Eastern Highlands bioregion

Scientific Name: *Themeda australis* – *Rytidosperma* spp. – *Poa sieberiana* – *Leptorhynchos squamatus* – *Chrysocephalum apiculatum*

Number of samples:	133
Richness [mean (±SD)]:	23 (7)
Slope (degrees):	(0) 1–4 (14)
Altitude (m asl):	(283) 641–820 (1185)
Ave. Annual Rainfall (mm):	(509) 647–716 (995)
Temp. Annual Range (°C):	(25.0) 26.7–28.0 (30.1)

Vegetation Description: Community r7 is an open to dense, mid-high to tall tussock grassland with the upper stratum dominated by *Themeda australis* and with a sub-dominance of *Rytidosperma* spp. and *Poa sieberiana*. Inter-tussock spaces are generally occupied by herbaceous taxa including *Chrysocephalum apiculatum*, *Leptorhynchos squamatus*, *Microlaena stipoides*, *Wahlenbergia* spp., *Asperula conferta*, *Juncus* spp., *Acaena ovina*, *Elymus scaber*, *Schoenus apogon* and *Plantago varia*. Isolated or scattered trees may be present, including *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus rubida*, *Eucalyptus aggregata*, *Eucalyptus melliodora*, *Acacia dealbata* or *Acacia mearnsii*. Isolated shrubs or patches of shrubs may also occur including *Melicytus* sp. 'Snowfields', *Hovea linearis*, *Pimelea glauca*, *Lissanthe strigosa*, *Daviesia latifolia*, *Daviesia mimosoides*, *Leucopogon fraseri*, *Melichrus urceolatus*, *Bossiaea buxifolia*, *Cryptandra amara* and *Kunzea parvifolia*. Trees and shrubs increase in density at ecotones with adjacent woodland communities. Relatively undisturbed sites have a variety of uncommon grassland forbs including *Hypericum japonicum*, *Tricoryne elatior*, *Pimelea curviflora*, *Microtis* spp., *Prasophyllum petilum*, *Calocephalus citreus*, *Eryngium ovinum*, *Craspedia* spp., *Ranunculus lappaceus*, *Rutidosis leptorrhynchoides*, *Bulbine bulbosa*, *Stackhousia monogyna* and *Wurmbea dioica*.

This community is found on midslopes and footslopes and to a lesser degree on flats. It is most commonly found on sedimentary, colluvium and granite lithologies, and infrequently on alluvium and basalt. It is distributed widely, being found in the Murrumbatemen and Crookwell subregions of the South Eastern Highlands, the Shoalhaven Valley, and in moister outer fringes of the Monaro region beyond rainshadow areas. Outliers occur near Tumberumba, Tumut, Bathurst and Orange. Severe winter and spring frosts, exposure to hot, drying westerly winds in summer, occasional waterlogging and the occurrence of cracking clays limit the establishment of woody taxa.

Community r7 grades into Community r2 [*Poa labillardierei* – *Themeda australis* – *Juncus* sp. wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands bioregion] and Community r3 [*Rytidosperma* sp. – *Themeda australis* – *Juncus* sp. tussock grassland of occasionally wet sites of the South Eastern Highlands bioregion] in moist depressions and drainage lines. Where distribution overlaps, it may be confused with Community r6 [*Dry tussock grassland of the Monaro in the South Eastern Highlands bioregion*]. Confusion between this community and those above may occur where the communities intergrade, especially in degraded sites (i.e. those lacking some of the main diagnostic taxa that define Community r7).



Plate r7: Widespread in the wetter locations such as this floristically diverse site at Steve’s TSR near Delegate, Community r7 is dominated by *Themeda australis*, with the forbs *Chrysocephalum apiculatum*, *Leptorhynchos squamatus* and *Asperula conferta* often occurring in high cover.

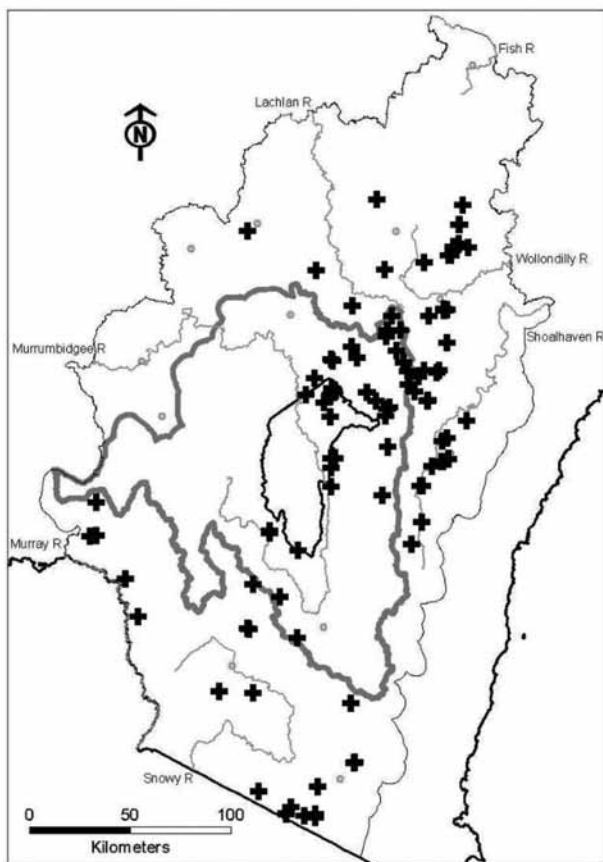


Fig. r7: Distribution of field samples assigned to this community.

Characteristic Species:

Species	C/A	Freq
<i>Acaena ovina</i>	1	61
<i>Asperula conferta</i>	1	59
<i>Austrostipa bigeniculata</i>	1	21
<i>Bothriochloa macra</i>	1	21
<i>Carex</i> spp.	1	35
<i>Chrysocephalum apiculatum</i>	2	79
<i>Convolvulus angustissimus</i>	1	40
<i>Dichelachne</i> spp.	1	26
<i>Drosera peltata</i>	1	26
<i>Elymus scaber</i>	1	50
<i>Epilobium</i> spp.	1	29
<i>Eryngium ovinum</i>	1	21
<i>Euchiton</i> spp.	1	64
<i>Glycine tabacina</i>	1	20
<i>Gonocarpus tetragynus</i>	1	42
<i>Haloragis heterophylla</i>	1	26
<i>Hypericum japonicum</i>	1	39
<i>Juncus</i> spp.	1	63
<i>Leptorhynchos squamatus</i>	2	70
<i>Lomandra bracteata</i>	1	40
<i>Luzula</i> spp.	1	36
<i>Microlaena stipoides</i>	1	49
<i>Microtis</i> spp.	1	26
<i>Oxalis perennans</i>	1	46
<i>Panicum effusum</i>	1	29
<i>Pimelea curviflora</i>	1	32
<i>Poa labillardierei</i>	1	25
<i>Poa sieberiana</i>	2	77
<i>Rumex dumosus</i>	1	54
<i>Rytidosperma</i> spp.	2	87
<i>Schoenus apogon</i>	1	41
<i>Scleranthus biflorus</i>	1	21
<i>Scleranthus fasciculatus</i>	1	20
<i>Solenogyne dominii</i>	1	30
<i>Solenogyne gunnii</i>	1	24
<i>Themeda australis</i>	6	100
<i>Tricoryne elatior</i>	1	39
<i>Triptilodiscus pygmaeus</i>	1	39
<i>Vittadinia muelleri</i>	1	27
<i>Wahlenbergia</i> spp.	1	69

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*; NC Act 1980 – *Natural Temperate Grassland*.

Equivalent vegetation types: Community 2 (Benson 1994), Group 7 (Rehwinkel unpub.).

Frequently occurring weeds: Like other grassland communities, the most frequently recorded weed species in this community include several common pasture weeds, as well as a number of noxious weeds. These include *Eragrostis curvula*, *Nassella trichotoma*, *Hypericum perforatum*, *Hypochaeris radicata*, *Acetosella vulgaris*, *Vulpia* spp., *Cirsium vulgare* and *Onopordum acanthium*.

Threats: This community has been extensively cleared and/or modified with remnants subject to small-scale clearing, weed invasion and grazing pressures.

Reservation status: Poorly reserved. Occurs in Turallo NR and Scabby Range NR, as may occur in conservation reserves in the ACT. Likely to occur at Dangelong NR. It is also known from a local government reserve near Bungendore (Days Hill Reserve) and Nature Conservation Trust covenanted lands in the upper Shoalhaven catchment.

Extent of clearing: Unknown, although throughout its range, only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Benson, J.S. (1994) The native grasslands of the Monaro region: southern tablelands of New South Wales. *Cunninghamia* 3: 609–650; Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report.

r8: *Themeda australis* – *Lomandra filiformis* – *Aristida ramosa* dry tussock grassland in the South Eastern Highlands bioregion

Scientific Name: *Themeda australis* – *Lomandra filiformis* – *Rytidosperma* spp. – *Microlaena stipoides* – *Aristida ramosa* – *Chrysocephalum apiculatum*

Number of samples:	18
Richness [mean (±SD)]:	26 (9)
Slope (degrees):	(0) 1–8 (13)
Altitude (m asl):	(453) 512–683 (876)
Ave. Annual Rainfall (mm):	(620) 658–673 (725)
Temp. Annual Range (°C):	(26.3) 27.5–28.3 (28.4)

Vegetation Description: Community r8 is an open to dense, mid to tall tussock grassland with the upper stratum dominated by *Themeda australis*, *Aristida ramosa*, *Lomandra filiformis* and *Austrostipa densiflora*. Other graminoids may include *Rytidosperma* spp., *Microlaena stipoides*, *Lomandra multiflora*, *Austrostipa scabra* and *Poa sieberiana*. Inter-tussock spaces are generally occupied by a diverse range of forbs including *Chrysocephalum apiculatum*, *Wahlenbergia* spp., *Pimelea curviflora*, *Goodenia hederacea* subsp. *hederacea* and *Gonocarpus tetragynus*. Isolated or scattered trees may be present including *Eucalyptus pauciflora* subsp. *pauciflora*, *Eucalyptus melliodora*, *Jacksonia scoparia*, *Acacia mearnsii* or *Acacia dealbata*. Isolated patches of shrubs may also occur including *Lissanthe strigosa*, *Hibbertia obtusifolia*, *Melichrus urceolatus*, *Astroloma humifusum*, *Bursaria spinosa*, *Dillwynia sericea* and *Dodonaea boroniifolia*. Trees and shrubs increase in density at ecotones with adjacent woodland communities, and shrubs may be especially dense in rocky areas. Relatively undisturbed sites have a variety of herbaceous taxa uncommon in grassland communities including *Pimelea curviflora*, *Tricoryne elatior*, *Dianella revoluta*, *Boerhavia dominii*, *Stylidium graminifolium sens. lat.*, *Bulbine glauca*, *Cymbopogon refractus* and *Dianella longifolia*.

This community is most commonly found on midslopes and upperslopes, although it can infrequently occur on rocky flats adjacent to creeks. It is found most commonly on soils derived from sedimentary strata and infrequently from granite, usually on steep exposed north-west-facing slopes, including in river gorges. Sites generally overlook extensive valleys or plains; thus they are subjected to hot, drying north-westerly winds in summer, which is a main determinant of species composition in this community. It is sparsely distributed, with isolated occurrences in the Yass, Goulburn, Tarago and Braidwood regions. Often, Community r8 occurs adjacent to Community r7 [*Themeda australis* – *Rytidosperma* sp. – *Poa sieberiana* moist tussock grassland of the South Eastern Highlands bioregion], which occurs on moister sites downslope. Confusion between these two communities is expected to occur where the communities intergrade, and especially in degraded examples (i.e. lacking some of the main diagnostic taxa that define these communities). Community r8 does not occur in the Monaro, where it is generally replaced by a subtype of Community r6 [*Dry Tussock Grassland of the Monaro in the South Eastern Highlands bioregion*].

Characteristic Species:

Species	C/A	Freq
<i>Acacia rubida</i>	1	21
<i>Acaena ovina</i>	1	21
<i>Aristida ramosa</i>	1	58
<i>Astroloma humifusum</i>	1	26
<i>Austrostipa bigeniculata</i>	1	21
<i>Austrostipa densiflora</i>	2	47
<i>Austrostipa scabra</i>	1	47
<i>Boerhavia dominii</i>	1	32
<i>Bothriochloa macra</i>	1	37
<i>Brachyloma daphnoides</i>	1	21
<i>Bulbine glauca</i>	1	26
<i>Bursaria spinosa</i>	1	26
<i>Carex</i> spp.	1	21
<i>Cheilanthes</i> spp.	1	37
<i>Chrysocephalum apiculatum</i>	2	63
<i>Convolvulus angustissimus</i>	1	21
<i>Crassula sieberiana</i>	1	21
<i>Cryptandra amara</i>	1	21
<i>Cymbopogon refractus</i>	1	26
<i>Dianella longifolia</i>	1	26
<i>Dianella revoluta</i>	1	42
<i>Dillwynia sericea</i>	1	26
<i>Diuris punctata</i>	1	21
<i>Dodonaea boroniifolia</i>	1	26
<i>Elymus scaber</i>	1	26
<i>Enneapogon nigricans</i>	1	26
<i>Eragrostis</i> spp.	1	26
<i>Euchina</i> spp.	1	53
<i>Glycine tabacina</i>	1	37
<i>Gonocarpus tetragynus</i>	1	42
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	1	53
<i>Hibbertia obtusifolia</i>	1	42
<i>Hovea linearis</i>	1	21
<i>Hypericum gramineum</i>	1	21
<i>Laxmannia gracilis</i>	1	21
<i>Leptorhynchus squamatus</i>	1	32
<i>Lissanthe strigosa</i>	1	47
<i>Lomandra filiformis</i>	2	100
<i>Lomandra longifolia</i>	1	32
<i>Lomandra multiflora</i>	1	58
<i>Luzula</i> spp.	1	26
<i>Melichrus urceolatus</i>	1	37
<i>Microlaena stipoides</i>	2	63
<i>Microtis</i> spp.	1	21
<i>Opercularia hispida</i>	1	21
<i>Oxalis perennans</i>	1	42
<i>Panicum effusum</i>	1	37
<i>Pimelea curviflora</i>	1	63
<i>Plantago varia</i>	1	21
<i>Poa sieberiana</i>	1	42
<i>Rumex brownii</i>	1	26
<i>Rytidosperma pallidum</i>	1	21
<i>Rytidosperma</i> spp.	2	68
<i>Schoenus apogon</i>	1	26
<i>Solenogyne dominii</i>	1	42
<i>Stylidium graminifolium sens. lat.</i>	1	32
<i>Thelymitra</i> spp.	1	21
<i>Themeda australis</i>	5	95
<i>Tricoryne elatior</i>	1	53
<i>Triptilodiscus pygmaeus</i>	1	26
<i>Vittadinia muelleri</i>	1	26
<i>Wahlenbergia</i> spp.	2	74
<i>Westringia eremicola</i>	1	21



Plate r8: Found on dry, steep, often west-facing sites, like this one in the Jerrabatgulla Creek area near Braidwood, Community r8 sites are often dominated or co-dominated by *Themeda australis* and *Aristida ramosa* and have a high cover of *Lomandra filiformis* and *Chrysocephalum apiculatum*, along with a diversity of other forbs and sub-shrubs.

Threatened communities: EPBC Act 1999 – *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory*. Although not yet assessed in the ACT, if confirmed this community would be listed under the NC Act 1980 – *Natural Temperate Grassland*.

Equivalent vegetation types: Group 8 (Rehwinkel unpub.).

Frequently occurring weeds: Consistent with other natural grassland communities described here, the most common weeds were either common pasture species, or noxious weeds. These include *Eragrostis curvula*, *Nassella trichotoma*, *Hypericum perforatum*, *Hypochaeris radicata*, *Acetosella vulgaris*, *Vulpia* spp., *Cirsium vulgare* and *Onopordum acanthium*.

Threats: This community has been extensively cleared and/or modified with remnants subject to small-scale clearing, weed invasion and grazing pressures.

Reservation status: Not known to occur in any formal conservation reserves, however it occurs on Nature Conservation Trust covenanted land in the upper Shoalhaven catchment.

Extent of clearing: Unknown, although throughout its range, only 3% of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* TEC remains in high ecological integrity, relative to its pre-European settlement extent (Environment ACT 2006).

References: Environment ACT (2006) National recovery plan for natural temperate grassland of the southern tablelands (NSW and ACT): an endangered ecological community. Environment ACT, Canberra; Rehwinkel, R. (unpublished) Revision of PATN analysis of grassland associations within the Natural Temperate Grassland Endangered Ecological Community in the Southern Tablelands of NSW. August 2009. NSW Department of Environment and Climate Change, Queanbeyan. Unpublished Report.

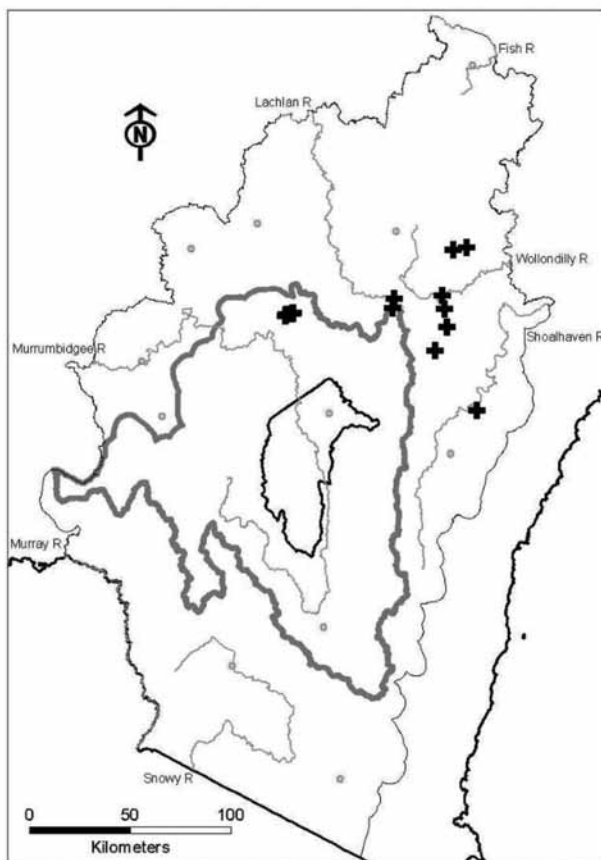


Fig. r8: Distribution of field samples assigned to this community.

Appendix 2: Equivalent communities in recent classifications

Prefixes: **a** (McDougall & Walsh 2007); **b** (Benson 1994); **bj** (Benson & Jacobs 1994); **g** (Gellie 2005); **e, m** and **p** (Tozer *et al.* 2010), **R** (Rehwinkel unpub.), **VCA** (Benson *et al.* 2010)

NOTE: In a new classification such as this, where new plot data are added and the spatial extent is different from previous classifications, exact equivalence between plant communities identified in different classifications is unlikely. In this table we identify the closest match to previous classifications and, where analysis of previous communities found no match in the current classification, we indicate which new plant communities the majority of plots were assigned to.

Plant Community (this study)	Equivalents and similar communities
a14: Prickly Snow-grass – Tufted Sedge subalpine valley grassland of the Australian Alps Bioregion	a14: Subalpine valley grassland; b7: <i>Poa costiniana</i> – <i>Epilobium billardierianum</i> subsp. <i>cinereum</i> – <i>Brachyscome scapigera</i> – <i>Asperula gunnii</i> montane, sod-tussock grassland
a2: Alpine Baeckea – Swamp Heath – Candle Heath – Sphagnum wetland of the Australian Alps Bioregion (Bog)	Combination of a2: <i>Richea continentis</i> – <i>Carpha nivicola</i> – <i>Sphagnum cristatum</i> wet heathland and a3: <i>Baeckea gunniana</i> – <i>Callistemon ptyoides</i> – <i>Sphagnum cristatum</i> wet heathland
a22: Snow-grass – Herbfield Celmisia – Woolly Billy-button grassland of the Australian Alps Bioregion	Combination of a18: <i>Poa fawcettiae</i> – <i>Uncinia sulcata</i> grassland and a22: <i>Poa fawcettiae</i> – <i>Euphrasia collina</i> grassland
a30: Dwarf Snow-grass – Fine-leaved Snow-grass – Silver Carraway – Granite Buttercup grassland of the Australian Alps Bioregion	Combination of a30: <i>Poa hiemata</i> – <i>Poa clivicola</i> grassland and a31: <i>Poa hookeri</i> grassland; b6: <i>Poa</i> spp. – <i>Geranium antrosum</i> – <i>Scleranthus biflorus</i> – <i>Leptorhynchus squamatus</i> – <i>Ranunculus graniticola</i> montane sod-tussock grassland
a33: Leafy Bossiaea – Mountain Cassinia – Yellow Kunzea – Alpine Hovea heathland of the Australian Alps Bioregion	Combination of a33: Northern Alps <i>Hovea montana</i> open heathland, a35: <i>Bossiaea foliosa</i> – <i>Epacris petrophila</i> heathland and a36: Broadway <i>Bossiaea foliosa</i> closed heathland
a34: Weeping Snow shrub-grass woodland of the Australian Alps Bioregion	a34: <i>Eucalyptus lacrimans</i> low open woodland
a38: Kangaroo Grass – Rodd's Bedstraw – Alpine Sunray grassland of steep limestone slopes in the Australian Alps Bioregion	a38: <i>Themeda triandra</i> – <i>Leucochrysum albicans</i> grassland
a39: Feldmark Heath – Carpet Heath – Snow-grass heath of the Australian Alps Bioregion	a39: Kosciuszko alpine <i>Epacris</i> – <i>Kunzea</i> open heathland
a42: Epacris – Fine-leaved Snow-grass – Bog Parrot-pea grassy heathland of the Australian Alps Bioregion	a42: <i>Epacris celata</i> – <i>Poa clivicola</i> open Heathland
a43: Dwarf Bossiaea – Kangaroo Grass low open heathland of the Australian Alps Bioregion	a43: <i>Bossiaea riparia</i> dwarf heathland
a46: Alpine Mint-bush – Alpine Orites – Kosciuszko Nematolepis shrubland in the Australian Alps Bioregion	Combination of a23: <i>Grevillea australis</i> – <i>Nematolepis ovatifolia</i> open heathland and a46: <i>Nematolepis ovatifolia</i> – <i>Prostanthera cuneata</i> closed heathland
a51: Mountain Plum Pine – Crag Wallaby-grass – Snow-daisy low sparse shrubland of rock outcrops of the Australian Alps Bioregion	a51: <i>Austrodanthonia alpicola</i> – <i>Grevillea australis</i> open heathland
a54: Mountain Plum Pine – Tall Rice-flower shrubland of screes and boulder-fields of the Australian Alps Bioregion	a54: <i>Podocarpus lawrencei</i> closed heathland
a6: Dwarf Buttercup – Mud Pratia – Tufted Sedge herbfield of shallow depressions in the Australian Alps Bioregion	a6: <i>Lobelia surrepens</i> – <i>Ranunculus millanii</i> herbfield
a7: Bog Buttercup – Creeping Raspwort herbfield of wetland margins in the Australian Alps Bioregion	a7: <i>Hypericum japonicum</i> – <i>Ranunculus pimpinellifolius</i> herbfield
a8: Tufted Sedge – Mud Water-milfoil – Tufted Hair-grass sedgeland of the Australian Alps Bioregion (Fen)	a8. Fen
a9: Tufted Sedge – Small River-buttercup – Common Reed aquatic herbfield of waterways in the Australian Alps and South Eastern Highlands Bioregions	a9: Aquatic
e24: Mountain Gum – Snow Gum very tall dry shrubby woodland to open forest primarily in the Kybeyan – Gourock subregion of the South Eastern Highlands Bioregion	Largely equivalent to e24: Subalpine Dry Shrub Forest (but includes plots originally assigned to p338). g64: Southern East Tableland Edge Shrub/Grass Dry Forest is divided between e24 and e26 (the latter of which occurs to the east outside the study area)
e59: Small-fruit Hakea – Mountain Baeckea – Myrtle Tea-tree subalpine bog heathland on the coastal ranges of the South Eastern Highlands Bioregion	e59: Southeast Sub-alpine Bog
g36: Button Tea-tree – Yellow Kunzea – Burgan dry shrubland on skeletal ridges primarily of the Namadgi Region	g36: Montane / Sub-Alpine Dry Rocky Shrubland

- L3: Freshwater sedge-herb marsh of shallow ephemeral lakes of the eastern South Eastern Highlands Bioregion
Approximately equivalent to bj3
- L4: Freshwater sedge-herb marsh of deep semi-permanent and/or slightly saline wetlands of the eastern South East ern Highlands Bioregion
A modification and range extension of bj4
- m31: Ribbon Gum – Snow Gum – Shiny Cassinia tall shrub-grass woodland to open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the NSW South Eastern Highlands
Largely a combination of g73: Eastern Tableland Dry Shrub/Grass Forest and g74: South Eastern Tablelands Dry Shrub/Grass/Herb Forest
- m51: Brittle Gum – Scribbly Gum shrub-grass tall dry sclerophyll woodland on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands Bioregion
Closest to g115: South East Tablelands Dry Shrub/Tussock Grass Forest but including some plots originally assigned to other communities (mainly g73, g75, g109, g110)
- p10: Black Sheoak – Silvertop Ash tall shrubby dry sclerophyll woodland to open forest primarily in the Bungonia subregion of the South Eastern Highlands Bioregion
A westward extension of p10: Eastern Tablelands Dry Forest; g15: North East Tableland Dry Shrub Forest
- p14: Red Stringybark – Scribbly Gum – Redanther Wallaby Grass tall grass-shrub dry sclerophyll woodland to open forest on loamy ridges of the central South Eastern Highlands Bioregion
A westward extension of p14; largely a combination of g114: Tablelands Dry Shrub/Tussock Grass Forest; and parts of g109: Widespread Tablelands Dry Shrub/Tussock Grass Forest and g121: Western Slopes Grass/Herb Dry Forest.
- p220: Ribbon Gum – Snow Gum tableland flats tall grassy woodland primarily on granitoids in the Kybean-Gourock and Monaro subregions of the South Eastern Highlands Bioregion
Largely equivalent to p220: Southern Tableland Flats Forest but contains several plots assigned in the same classification to p520: Tableland Swamp Flats Forest. Contains plots from g73: Eastern Tableland Dry Shrub/Grass Forest and g74: South Eastern Tablelands Dry Shrub/Grass/Herb Forest.
- p32d: River Sheoak dry forest on sand/gravel alluvial soils along major watercourses of the South Eastern Highlands and upper South Western Slopes Bioregions
VCA 85: River Oak forest and woodland wetland of the NSW South-western Slopes and South Eastern Highlands Bioregions
- p338: Brown Barrel wet sclerophyll very tall grass-herb open forest primarily of the Gourock and Tallaganda Ranges in the South Eastern Highlands Bioregion
p338: Southern Range Wet Forest; combination of g55: Eastern Tableland Fern/Herb/Grass Moist Forest, g56: Tableland and Escarpment Moist Herb/Fern Grass Forest and part of g95: Tableland Acacia Moist Herb Forest.
- p520: Ribbon Gum swamp very tall woodland on sandy alluvial soils along drainage lines of the eastern South Eastern Highlands Bioregion
Largely equivalent to p520: Southern Tableland Flats Forest. Contains plots from g89: Eastern Tablelands Acacia/Herb/Grass Forest and g146: Tableland Dry Herb/Grass Woodland.
- p56: Mountain Tea-tree – Small-fruit Hakea – River Lomatia riparian shrubland of the eastern South Eastern Highlands Bioregion
Equivalent to p56
- p8: Silvertop Ash – Narrow-leaved Peppermint tall shrubby dry sclerophyll woodland to open forest primarily on sedimentary ridges of the eastern South Eastern Highlands Bioregion
p8: Tableland Ridge Forest; a combination of g59: Eastern Tableland and Escarpment Shrub/Fern Dry Forest and g112: Eastern Tablelands Dry Shrub Forest.
- r1: Sub-montane moist tussock grassland of the South Eastern Highlands Bioregion
r1: Sub-montane moist tussock grassland of the South Eastern Highlands Bioregion
- r2: River Tussock – Kangaroo-grass – Rush wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands Bioregion
b8: *Poa labillardieri* tall tussock grassland, R2: River Tussock – Kangaroo-grass – Rush wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands Bioregion, VCA635: River Tussock – Kangaroo – Grass – Rush wet tussock grassland of footslopes, drainage lines and flats of the South Eastern Highlands Bioregion.
- r3: Wallaby-grass – Kangaroo Grass – Rush tussock grassland of occasionally wet sites of the South Eastern Highlands Bioregion
r3: Wallaby-grass – Kangaroo Grass – Rush tussock grassland of seasonally wet sites of the South Eastern Highlands Bioregion. VCA637: Wallaby-grass – Kangaroo Grass – Rush tussock grassland of seasonally wet sites of the South Eastern Highlands Bioregion.
- r4: Lacustrine ephemeral grassland of the South Eastern Highlands Bioregion
r4: Lacustrine ephemeral grassland of the South Eastern Highlands Bioregion. VCA636: Lacustrine Ephemeral Grassland of the South Eastern Highlands Bioregion.
- r5: Wallaby-grass – Tall Speargrass – Common Everlasting tussock grassland of the South Eastern Highlands Bioregion
b1: *Danthonia* spp. – *Asperula conferta* – *Bothriochloa macra* low grassland on the northern Monaro, r5: Wallaby-grass – Tall Speargrass – Common Everlastings tussock grassland of the South Eastern Highlands Bioregion.
- r6: Dry tussock grassland of the Monaro in the South Eastern Highlands Bioregion
Combination of b3: *Themeda australis* – *Poa sieberiana* – *Chrysocephalum apiculatum* – *Acaena ovina* tall grassland and b4: *Poa sieberiana* – *Acaena ovina* grassland on basalt, southern Monaro; r6: Dry tussock grassland of the Monaro in the South Eastern Highlands Bioregion.

- r7: Kangaroo Grass – Wallaby-grass – Snow-grass moist tussock grassland of the South Eastern Highlands Bioregion
- r8: Kangaroo Grass – Purple Wire-grass – Wattle Mat-rush dry tussock grassland in the Southern Tablelands region of the South Eastern Highlands Bioregion
- L12: Freshwater sedge-herb marsh of shallow, commonly inundated wetlands of the eastern South Eastern Highlands Bioregion
- p23: Red Stringybark – Broad-leaved Peppermint tall dry sclerophyll grassy woodland on loamy rises primarily in the Bungonia subregion of the South Eastern Highlands Bioregion
- p24: Yellow Box – Blakely's Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands Bioregion
- p9: Brittle Gum – Scribbly Gum tall shrubby dry sclerophyll woodland on infertile low ridges and hills primarily of the Bungonia subregion of the South Eastern Highlands Bioregion
- u105: Broad-leaved Peppermint – Brittle Gum – Red Stringybark tall shrub-grass dry sclerophyll woodland to open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes Bioregions
- u118: Black Sallee grass-herb woodland in drainage depressions and moist valley flats in the South Eastern Highlands and Australian Alps Bioregions
- u148: Red Stringybark – Red Box grass-forb tall woodland to open forest of the upper South Western Slopes and western South Eastern Highlands Bioregions
- u150: Broad-leaved Peppermint – Mountain Gum tall grass-forb woodland to open forest of the South Eastern Highlands and Australian Alps Bioregions
- u152: Robertson's Peppermint – Red Stringybark very tall grass-forb sheltered woodland to open forest of the southwest South Eastern Highlands and upper South Western Slopes Bioregions
- u158: Alpine Sallee mid-high shrub-grass subalpine woodland of the Australian Alps Bioregion
- u159: Black Sassafras temperate rainforest of wet sheltered slopes in the Australian Alps Bioregion
- u165: Robertson's Peppermint very tall shrubby woodland to open forest primarily of the Bondo subregion of the South Eastern Highlands
- u173: River Red Gum +/- Apple Box very tall grass-forb riparian woodland on alluvial flats in the South Eastern Highlands and upper South Western Slopes Bioregions
- u178: Yellow Box – Apple Box tall grassy woodland of the South Eastern Highlands
- u18: Bundy – Broad-leaved Peppermint mid-high shrubby woodland to open forest on granite substrates primarily in the Namadgi Region
- u181: River Bottlebrush – Burgan rocky riparian shrubland in the South Eastern Highlands and upper South Western Slopes Bioregions
- u19: Blakely's Red Gum – Yellow Box +/- White Box tall grassy woodland of the Upper South Western Slopes and western South Eastern Highlands Bioregions
- u191: Black Cypress Pine – Brittle Gum tall dry woodland on hills primarily in the Cooma Region
- u193: Small-fruit Hakea – Drumstick Heath – Swamp Heath Subalpine Swamp Heathland of the Australian Alps and western South Eastern Highlands Bioregions
- b2: *Themeda australis* – *Juncus filiformis* grassland of the ACT; r7: Kangaroo Grass – Wallaby-grass – Snow-grass moist tussock grassland of the South Eastern Highlands Bioregion.
- r8: Kangaroo Grass – Purple Wire-grass – Wattle Mat-rush dry tussock grassland in the Southern Tablelands region of the South Eastern Highlands Bioregion.
- Combination of bj1 and bj2.
- Largely equivalent to p23: Tableland Hills Grassy Woodland but with many new plots to the west and some plots originally assigned to p24: Tableland Grassy Box-Gum Woodland.
- Largely equivalent to p24: Tableland Grassy Box-Gum Woodland. but with many new plots to the west
- Largely equivalent to p9: Tableland Low Woodland but including some plots originally assigned to p14, p15 and p23.
- Largely a combination of g108: Western Tablelands Dry Herb/Grass Forest and g110: Tablelands Dry Shrub/Grass Forest but with some plots originally assigned to other communities (mainly g103 and g109).
- No equivalent. All but one plot was not available for previous classifications.
- No clear equivalent; contains many new plots and plots originally assigned to g116: Western Slopes Herb/Grass Woodland, g119: Western Tablelands Dry Shrub/Grass Forest, g120: Western Slopes Shrub/Herb/Grass Dry Forest and g121: Western Slopes Grass/Herb Dry Forest and has affinities with VCA290: Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass – shrub low open forest on hills in the southern part of the NSW South-western Slopes Bioregion
- Most similar to g103: Western Montane Dry Fern/Grass Forest but contains plots originally assigned to several other communities (mainly g75, g105, g107, g109, g110).
- Largely a combination of g93: Western Tablelands Herb/Grass Dry Forest and g94: South West Slopes Acacia Dry Herb/Grass Forest but including some plots originally assigned to other communities (mainly g103, g104 and g119)
- Combination of g128: Sub-alpine Dry Shrub/Herb Woodland and g130: Sub-alpine Shrub/Grass Woodland with many new plots.
- Largely equivalent to g172: Kosciuszko Western Escarpment Cool Temperate Rainforest
- Similar to VCA295; incorporates g106: Montane Dry Shrub/Tussock Forest but including some plots originally assigned to other communities (mainly g103, g104 and g82)
- Largely defined by new plots but incorporates g43: Western Slopes Riparian Moist Sedge Woodland.
- Largely defined by new plots but contains several plots previously assigned to g160: Northern Slopes Dry Grass Woodland
- Probably similar or equivalent to g79: Montane Dry Shrub/Tussock Grass Forest.
- Largely defined by new plots; contains plots originally assigned to g82: Western Montane Acacia Fern/Herb Forest.
- Incorporates g117: Western Slopes Dry Grass Woodland and contains plots previously assigned to g116: Western Slopes Herb/Grass Woodland, g154: Tableland Dry Grassy Woodland and g160: Northern Slopes Dry Grass Woodland
- No equivalent but possibly related to g79: Montane Dry Shrub/Tussock Grass Forest.
- Largely defined by new plots; contains plots originally assigned to g123: Montane Wet Heath/Bog and g124: Western Montane Wet Heath/Herb Grass Woodland.

u20: Kurrajong – Blackthorn – Kangaroo Grass mid-high shrub-grass open woodland on limestone karsts in the Wee Jasper area	No equivalent; defined by new plots.
u207: Jounama Snow Gum – Snow Gum mid-high shrubby woodland on granitoids primarily of the Namadgi Region	Probably equivalent to g127: Sub-alpine Dry Shrub/Herb/Grass Woodland but mostly defined by new plots.
u21: Broad-leaved Peppermint – Candlebark tall dry sclerophyll woodland to open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps Bioregions	Largely defined by new plots but contains plots previously assigned to g74: South Eastern Tablelands Dry Shrub/Grass/Herb Forest and g75: Tablelands Shrub/Tussock Grass Forest
u22: Mountain Gum – Snow Gum grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands Bioregions	Incorporates g97: Montane Acacia/Dry Shrub/Herb/Grass Forest and g100: ACT Montane Dry Shrub/Grass Forest with plots from g95: Tableland Acacia Moist Herb Forest, g96: Tableland Tussock Grass/Herb Forest, g99: Montane Dry Shrub/Herb/Grass Forest, g101: North-Western Montane Dry Shrub/Herb/Grass Forest, g102: Brindabella Montane Dry Fern/Grass Forest, g103: Western Montane Dry Fern/Grass Forest, and g104: Tableland Acacia/Herb/Grass Forest
u23: Snow Gum – Drumstick Heath – Myrtle Tea-tree tall woodland to open forest of drainage depressions primarily of the South Eastern Highlands Bioregion	Defined by many new plots but includes plots previously assigned to g124: Western Montane Wet Heath/Herb Grass Woodland and g146: Tableland Dry Herb/Grass Woodland.
u239: Alpine Ash – Mountain Gum +/- Snow Gum wet sclerophyll open forest of the Australian Alps and South Eastern Highlands Bioregions	No clear equivalent; mostly new plots but incorporates some plots from g86, g87, g99 and g102
u27: Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies primarily of the South Eastern Highlands Bioregion	No equivalent. Defined by plots not used in previous classifications. May have some affinities with g100.
u28: Snow Gum – Mountain Gum – <i>Daviesia mimosoides</i> tall dry grass-shrub subalpine woodland to open forest of the Australian Alps and South Eastern Highlands Bioregions	Mostly defined by new plots but contains some plots previously assigned to g98: Western Montane Moist Shrub Forest
u29: Apple Box – Broad-leaved Peppermint tall shrub-grass woodland primarily on granitoids of the South Eastern Highlands Bioregion	No equivalent; defined by plots not used in previous classifications.
u40: Alpine Ash very tall wet sclerophyll woodland primarily of the Australian Alps Bioregion	Closest to g87: Western Escarpment Moist Shrub/Herb/Grass Forest but with many new plots and a few plots from g82 and g86
u43: Bundy – Hickory Wattle – Drooping Sheoak – Western Wedding Bush tall grassy open woodland Serpentine in the Coolac-Goobarrandra area of the upper NSW Southwestern Slopes Bioregion	Equivalent to VCA301: Drooping Sheoak – <i>Ricinocarpus bowmannii</i> – grass-tree tall open shrubland of the Coolac – Tumut Serpentine Belt.
u52: Ribbon Gum – Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands Bioregion	Largely a combination of g82: Western Montane Acacia Fern/Herb Forest, g83: Montane Riparian Moist Shrub/Grass/Herb Forest and g102: Brindabella Montane Dry Fern/Grass Forest
u53: Mountain Gum – Blackwood tall wet sclerophyll open forest primarily on granitoids of the Australian Alps and western South Eastern Highlands Bioregions	Most closely related to g86: Western Sub-alpine Moist Shrub Forest but including some plots originally assigned to g85
u66: Bundy – Red Stringybark mid-high grassy herbaceous open woodland of the South Eastern Highlands and Upper Slopes Subregion of the South Western Slopes Bioregion	No equivalent; defined by plots not used in previous classifications.
u78: Snow Gum mid-high grassy woodland of the South Eastern Highlands Bioregion	Comprises plots mostly from p22: Frost Hollow Grassy Woodland and p24: Tableland Grassy Box-Gum Woodland. The community is effectively a subset of those communities.

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